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THE GENUS *SAVIA* (EUPHORBIACEAE) IN EXTREME WESTERN TEXAS

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ABSTRACT. Key, synonymy, descriptions, and information on distribution and ecology are given for the two species recognized. These are *Savia phyllanthoides* (Nutt.) Pax & K. Hoffm. and *S. arida*, new species, with type from Brewster County, Texas.

We provide key, synonymy, detailed descriptions, and information on distribution and ecology for the two species of the primarily tropical genus *Savia* which occur in extreme western Texas. We are indebted to Dr. Grady L. Webster of Purdue University for going over the manuscript and providing valuable comments and suggestions. Hannah Croasdale of Dartmouth College provided the Latin diagnosis. We are grateful to the personnel of the several herbaria which loaned specimens for study; these herbaria are abbreviated in the citations according to Lanjouw and Stafleu (1956).

Savia Willd., Sp. Pl. 4: 771, 1806.

KEY TO THE SPECIES OF SAVIA IN THE TRANS-PECOS AND ADJACENT COUNTIES

Leafy twigs 10–30(–55) cm long, usually weakly arcuate; leaf-blades mostly more than 10 mm long; staminate pedicels 6–12 mm long; pistillate pedicels 8–22 mm long..... 1. *S. phyllanthoides* (Nutt.) Pax & K. Hoffm.

Leafy twigs 5–10 cm long, grayish white, rigidly straight; leaf-blades mostly less than 10 mm long; staminate pedicles 2–3.2 mm long, pistillate pedicels 3–4 mm long. 2. *S. **arida*** Warnock & Johnston

1. SAVIA PHYLLANTHOIDES (Nutt.) Pax & K. Hoffm., Das Pflanzenr. IV 147 XV (Heft 81): 184, 1922. Based on *Lepidanthus phyllanthoides* Nutt., Trans. Amer. Phil. Soc. n.s. 5: 175, 1835 [not 1837]. Windingstair Mountains, western LeFlore County, eastern Oklahoma, just north of present town of Talihina, *Nuttall*, May 18, 1819 (BM?, PH?). Nuttall says in his journals (ex Geiser, 1956) that at this place he found a "shrubby plant allied to Phyllanthus." *Andrachne phyllanthoides* (Nutt.) Coulter, Contr. U. S. Natl. Herb. 2: 396, 1894 [comb.

not made by Mueller, as given by Fernald (1950: 963) and other authors].

Mostly glabrous low unarmed shrubs (to 1 meter tall, says Fernald, 1950: 963); occasionally rooting adventitiously from lower parts of woody decumbent stems; taproots unknown; stems numerous, the older ones 2–4(–6) mm thick and acquiring a thin, brownish gray, smooth or minutely fissured or eventually flaky bark; leafy branches numerous, usually 0.7–1.7 mm thick, reddish brown, usually glabrous or sparsely white hairy, often striate, 10–30(–55) cm long, often arcuate, weak, and bending when long; internodes 0.3–1.4 cm long (usually considerably shorter than the subtending leaves).

LEAVES alternate; blades elliptic-oblong to obovate-oblong, occasionally nearly round, (6–)10–15(–32) mm long, 1–1.6 times as long as broad, apically usually rounded, occasionally emarginate, rarely shortly acute, basally rounded or very shortly tapered or rarely very shallowly cordate, marginally entire, rather thin but firm with no tendency to roll on drying, usually drying dull grayish-green or brownish-green, often slightly reticulate (impressed above, raised below), with midvein and ca. 6 pairs of arcuate laterals, usually glabrous except sparsely short pilose along the veins beneath; petioles 0.5–2.1(–3.4) mm long, purplish or reddish brown, mostly glabrous, grooved adaxially; stipules narrowly deltoid to lanceolate-subulate, 0.9–1.7 mm long, thin hyaline, rich purplish brown; strigose, at least along the margins; axial bud scales also dark, colored like the stipules.

FLOWERS dioecious, solitary in the distal axils, long-pedicellate.

STAMINATE FLOWERS: pedicels 6–12 mm long, very slender and usually arcuate, stramineous to ochroleucous, glabrous or sparsely strigose; calyx deeply 5-lobed, rotate, 4.5–7 mm across, the limb 1.2–1.6 mm in diam., the lobes remote, oblong-linear, 1.5–2 mm long, rounded and slightly dilated distally; the whole stramineous and purplish green, pilose on back and pilose-fringed at the apex; petals not quite as long as sepals or a little longer, 1.2–2.1 mm long from edge of disk, oblanceolate, acute, hyaline, spreading; disk 1.2–2.5 mm in diam., rather thin, pale ochraceous to pale purplish, crenate or erose marginally, flat; stamens 5, opposite the calyx-lobes, strongly arcuate outward, ca. 1.5–2.1 mm long, the filaments quite glabrous slender; rudimentary ovary central, consisting of 3 slender terete tapering style-like columns distinct to the base, 1–1.2 mm long, stramineous.

PISTILLATE FLOWERS: pedicels 8–12(–22) mm long, reddish or purplish brown, rather slender, thickened just beneath the calyx, rigid, arcuate, glabrous or sparsely short pilose; calyx of 5 subequal sepals distinct nearly to the base, the whole nearly rotate and 7–11 mm in

diameter; sepals obovate, broad (overlapping even at maturity), rounded apically, 3–4 mm long, rather thickened (middle part 0.1 mm thick), purplish-green to reddish-brown, glabrous or minutely pilose-fringed especially at the apex, ultimately hardened, darkened, and reflexed in fruit, but not accrescent; petals narrowly elliptical to oblanceolate, 1–1.2 mm long, hyaline, ochroleucous; disk 2 mm across, thin, irregularly erose marginally; ovary sessile, depressed globose, often bluish purple, almost glaucous; styles 3, 1–1.3 mm long, spreading, purplish-brown, bifid about half their lengths, the divisions with narrow fungoid stigmatic enlargements on the adaxial surfaces, recurved.

CAPSULES depressed globose, shallowly and roundly 3-lobed, 4–5 mm long, ca. 7–7.5 mm in diam., dark gray to brownish to fuscous, becoming woody; columella rather stout, ca. 3 mm long, with 3 minute alar processes at summit and 3 small retrorse rhynchoid processes basally.

SEEDS 2 per cell, collateral, wedge-shaped, subpyriform, 3–3.2 mm long, brownish, smooth, ca. 2 mm across the facets, 2.1 mm across the rounded dorsum, largest below the middle.

RANGE. Plants of this species are known north as far as Christian, Stone, Barry, and Taney counties in southwestern Missouri; Carroll and Garland counties in western Arkansas; and several localities in eastern Oklahoma, including the type locality. They are apparently uncommon in north-central Texas (Shinners, 1958: 241). In south-central Texas they are known from Bexar, Comal, Kendall, Kerr, Travis, and Val Verde counties. The Val Verde County records, on the basis of which we include this species, are cited by Torrey (1859: 193): "Ravines on the San Pedro [=Devil's] river, *Bigelow, Schott.*" We have also seen one more specimen: Val Verde County, near mouth of Pecos River, *V. Havard s.n.*, October 1883 (U.S., sterile).

C. H. and M. E. Mueller have collected specimens (TEX) of this species, or a very closely related one, in the limestone mountains of central Nuevo Leon.

ECOLOGY: These plants occur apparently throughout their range in limestone uplands, and are more abundant near creeks and rivers, though occurring also on drier slopes and in barrens.

FLOWERING: April, May, and June.

2. SAVIA **ARIDA** Warnock & Johnston, new species. Frutices humiles; folia alternata, solida brevipetiolata, integra, elliptico-obovata ad spatulata, 4–10 mm long, 1.2–2 plo longiora quam lata, pilis brevibus adpressis parce vestita; stipulae singulares, discos tenues habentes; flores staminei in pediculis 2–3 2 mm long. positi, habentes calycem

profunde 5-lobatum ca. 4 mm diam., atque 5 petala obovata, minora quam lobi calycis, his atque illis alternantibus, atque 5 stamina perspicua extrorsus deflexa, his atque petalis alternantibus, atque rudimentum centrale e 3 organis styliformibus simplicibus erectis constans; flores pistillati in pediculis 3–4 mm long. positi, habentes calycem profunde 5-lobatum 5.25–5.5 mm lat., lobis ovatis, atque 5 petala 1/3 breviora quam lobi calycis, his illis alternantibus, atque ovarium tricellulare; capsula 3.5–4 mm long., 7 mm lat., obscure 3-lobata; dua semina in unoquoque loculo, collateralia, cuneata, 2.7–3 mm longa, quasi levia.

Unarmed, intricately-branched shrubs (25–)40–60(–75) cm tall; taproots dark-barked, conforming in shape to the rock-crevices, mostly (6–)10–15(–22) mm thick; main stems from crown 1(–2–3), as much as 15 mm thick basally, with dark brown very rough bark showing deep fissures; younger branches much slenderer with whitish flaky bark peeling in narrow strips; leafy twigs 5–10 cm long, pale, fairly densely appressed short-pubescent, rigid, straight, tapering, 1 mm or less thick; internodes ca. 5 mm long.

LEAVES alternate, slightly retrorse on the stems; blades small, elliptic-obovate to spatulate, ca. 4–10 mm long, and 1.2–2 times as long as broad, apically rounded or obscurely mucronulate, basally rounded, marginally entire, rather firm, green to yellowish-green, porulose, pubescent on both surfaces with short mostly appressed hairs slightly crisped and not so dense as on the stems; midribs prominent on both surfaces near the base; petioles ca. 1 mm long, maroon, or purple, emerging from tiny buttresses; scales of the axillary buds dark maroon or purplish black; stipules triangular-acuminate, the largest ca. 1 mm long and 0.7 mm wide near the base, pubescent with hairs like the leaves and about as dense, brownish or purple-brown when young, persistent and turning dark maroon and purplish black like the axillary bud scales.

FLOWERS strictly dioecious.

STAMINATE FLOWERS usually solitary, uncommonly in twos, rarely in threes in the upper axils; pedicels ca. 2–3.2 mm long, slender but rigid and ascending, yellowish-green sparsely pilose; calyx shallowly campanulate, or nearly rotate, of 5 nearly distinct spreading sepals which are imbricate in bud, green medially with broad white translucent lacerate-ciliate margins (which are reflexed apically), densely pubescent beneath (hairs longer toward the margins and tips), broadly oblong-obovate, obtusish, ca. 1.8–2 mm long from base of calyx or 1.1–1.3 from the edge of the disk; petals well-developed, 5, inflexed in bud, alternate with the sepals, rising from beneath the disk but distinct

from it, smaller than the sepals, thin, yellowish-green, obovate, acute apically, truncate basally, ca. 0.9–1.0 mm long; disk flat, fleshy, yellowish-green, nearly round, the margins thin and irregularly undulate, ca. 1.2 mm in diam.; stamens 5, opposite the sepals and alternate with the petals, essentially free from the disk and from each other, rising from the base of the rudiment, the filaments rather thick at base, tapering, white, less than 1 mm long, arching outward at anthesis; anthers relatively large, yellow, 2-celled or appearing 4-celled because of the deep sulci at the longitudinal sutures of dehiscence, the 2 thecae parallel, pendulous from opposite sides of the apex of the filament; the rudimentary ovary consisting of 3 smooth, whitish, columnar, simple, style-like organs rising centrally ca. three-fourths as long as the filaments.

PISTILLATE FLOWERS: solitary or rarely paired in the upper axils; pedicels 3–4 mm long, hairy but not so densely as the adjoining stem; calyx deeply 5-lobed, the limb ca. 1.5 mm in diam., the whole with lobes spread 5.25–5.5 mm in diam., the lobes ca. 1–1.5 mm wide, ovate, acute, greenish yellow on outer surface, and hairy upper surface glabrous; margins narrow, hyaline; petals 5, alternating with calyx lobes, arising from beneath the fleshy disk, very small, scarcely reaching the middle of the calyx lobes, about a third as long as the calyx lobes, ovate, acute, brownish and papery, disk irregularly crenate or obscurely star-shaped with points opposite the calyx-lobes, brown; ovary sessile, 3-carpellate, 3-lobed, with 2 collateral ovules in each cell; styles 3, prominent, spreading, brownish, each ca. 1 mm long, bifid about at the middle, the 2 rami widely spreading (angle 30–50°) and curved erect, not capitellate but the stigmatic ends slightly darker in color.

CAPSULES: 3-celled, depressed-globose, slightly tricoccous, 3.5–4 mm long, ca. 7 mm across, brownish, rugulose, somewhat woody and tough at maturity, glabrous or with a few sparse pilose hairs when immature; columella 2.5–3 mm long, brownish, rather stout.

SEEDS: 6, 2 per locule, collateral, wedge-shaped, 2.7–3 mm long, 2 mm across facet, 2.2 mm across the rounded dorsum, fuscous or almost black, smoothish or rugulose.

HOLOTYPE: Brewster County, Texas, middle western slopes of Dead Horse Mountains, alt. ca. 3800–4000 feet, 29°25′N by 103°2′W, crevices in massive lower Cretaceous limestone, associated with *Vauquelinia angustifolia* Rydb. and *Fraxinus Greggii* Gray, etc., *Warnock & Johnston 16840*, Sept. 21, 1958 (SRSC). This number is exclusively the staminate material; the pistillate material of the same collection is numbered *16841*.

RANGE: These plants are known from only two localities; in addition to the type collection itself, plants have been collected at the type locality on July 19, 1952 (*Warnock 10767*, SRSC, etc.) and on July 11, 1958 (*Warnock 16681*, SRSC, with a few old capsules, all pistillate). The other locality is as follows: Presidio County, small west-trending canyon in Glen Rose limestone, alt. 4200–4300 ft., 29°27½′N by 103°51½′W, rooting in crevices with *Quercus Hinckleyi* Muller and *Agave lecheguilla* Torr., *M. C. Johnston 3461* (staminate), and *3462*, (pistillate) Oct. 12, 1958 (SRSC).

ECOLOGY: The plants of this rare and local species occur in the so-called desert-scrub, but they are closely related to the *S. phyllanthoides* of more mesic situations to the northeast. At both of the localities cited there are perhaps a total of 350 plants. We may speculate that these plants are "relics" of a cooler, more moist climate; in the Presidio County locality the total extent (perhaps 2 acres) of the colony of *Savia arida* is only slightly larger than that of *Quercus Hinckleyi* Muller with which it is associated.

Interestingly enough, Muller (personal communication) regards his *Quercus Hinckleyi*, which is known only from this one locality, as a "relic"; it does not seem to be capable of reproducing itself by acorns under the present rigorous conditions, but spreads by rhizomes in the crevices; the apparent absence of *Quercus Hinckleyi* and of *Savia arida* from hundreds of square miles of seemingly identical slopes adjacent to this locality does not seem to be an illusion due to insufficient exploration.

The fact that these shrubs have survived in areas which have in the past been heavily browsed by goats may indicate that they are unpalatable.

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THE SOUTHWESTERN NATURALIST 5 (1): 7–11 APRIL 15, 1960

A CYTOLOGICAL DIFFERENCE BETWEEN THE EUPANICOIDEAE AND THE CHLORIDOIDEAE (GRAMINEAE)

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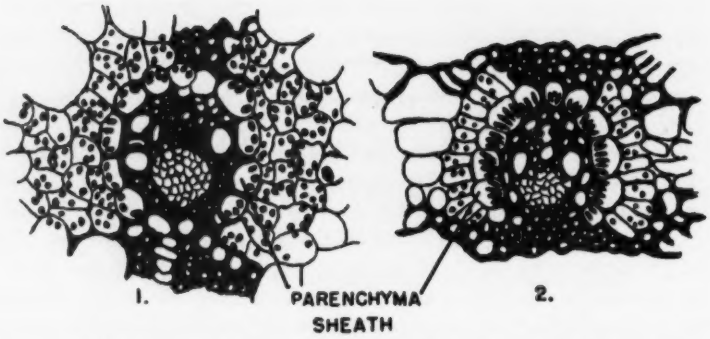
ABSTRACT. Examination of chloroplast distribution in the parenchyma sheath cells of 59 species of panicoid grasses has revealed that the Euphanicoideae and the Chloridoideae differ for this character. In all 28 species of the Eupanicoideae the chloroplasts, when devoid of starch, are grouped in the outer (centrifugal) region of the parenchyma sheath cells. Among the Chloridoideae, except the tribe Sporoboleae, the chloroplasts are grouped in the inner (centripetal) region of the cells. Both conditions in about equal numbers of species were found in the Sporoboleae. The distribution of chlroplasts is probably associated with the different physiological activities of chloroplasts in these two subgroups of the Panicoideae.

Among the various major subgroups of the grass family there are many differences of anatomy, physiology, cytology, ecology, histology, and embryology (Stebbins, 1956; Brown, 1958). Recently Stebbins (1959) has compiled a list of 36 characters that can be used to separate grass tribes and recognize affinities among genera. The two major subgroups of the subfamily Panicoideae, the Eupanicoideae and Choridoideae, differ with respect to leaf histology (Prat, 1936); presence or absence of the epiblast (Reeder, 1957); and in leaf anatomy (Brown, 1958). Recently a new diffierence was detected between these two groups.

While examining microscope slides used in the preparation of a paper to be presented before the 9th International Botanical Congress (Brown, 1959) and which had served as the basis for a previous paper (Brown, 1958) it was noticed that in the parenchyma sheath cells of the Panicoideae the chloroplasts, when not full of starch grains, occupied positions either close to the inner (centripetal) wall or near the outer (centrifugal) wall. It seemed that the outer position occurred in eupanicoid species whereas the inner position was characteristic of the Chloridoideae (fig. 1 and 2). All available slides of leaf cross sections of species in these groups were examined and information on chloroplast location recorded (table 1). Data were collected from 59 species, of 44 genera, of 8 tribes.

In all 28 species of Eupanicoideae the chloroplasts were grouped in the outer region of the parenchyma sheath cells. Among the Chlori-



Figs. 1 and 2. Transverse sections of bundles, sheaths, and surrounding tissues of leaves of two panicoid grasses. Fig. 1. A transverse section of a vascular bundle, parenchyma sheath, and surrounding mesophyll of a leaf blade of *Eremochloa ophiuroides* (Andropogoneae, Eupanicoideae). Chloroplasts in outer regions of the parenchyma sheath cells. Fig. 2. A transverse section of part of a leaf of *Hilaria belangeri* (Zoysieae, Chloridoideae). Chloroplasts in inner regions of the parenchyma sheath cells.

TABLE 1

The locations of plastids in parenchyma sheath cells of some panicoid grasses

	PLASTIDS OF PARENCHYMA CELLS LOCATED NEAR:	
	the centripetal wall	*the centrifugal wall*
EUPANICOIDEAE		
PANICEAE		
		Brachiaria ciliatissima
		Cenchrus myosuroides
		C. pauciflorus
		Digitaria sanguinalis
		Echinochloa colonum
		Eriochloa sericea
		Panicum reptans
		P. texanum
		Paspalum monostachyum
		P. pubiflorum
		Pennisetum villosum
		Setaria leucopila
		Stenotaphrum secundatum
		Trichachne patens
ANDROPOGONEAE		
		Arthrolophis saccharoides
		Bothriochloa ischaemum
		Elyonurus tripsacoides
		Eremochloa ophiuroides
		Erianthus strictus
		Heteropogon contortus
		Hyparrhenia hirta
		Manisuris cylindrica
		Schizachyrium scoparium
		Sorghastrum nutans
		Sorghum halepense
		Trachypogon montuferi
MAYDEAE		
		Tripsacum dactyloides
		Zea mays

CHLORIDOIDEAE

CHLORIDEAE

Cynodon dactylon
Bouteloua rigidiseta
B. trifida
Buchloe dactyloides
Chloris ciliata — Chloris andropogonoides
Leptochloa dubia
Schedonnardus paniculatus
Trichloris pluriflora
Tripogon spicatus

ERAGROSTEAE

Eragrostis cilianensis
E. curvula
Distichlis texana
Monanthochloe littoralis
Tridens elongatus
T. eragrostoides
T. pilosus
Vaseyochloa multinervosa

PAPPOPHOREAE

Blepharidachne bigelovii
Pappophorum bicolor

ZOYSIEAE

Hilaria belangeri
H. mutica

SPOROBOLEAE

Lycurus phleoides — Muhlenbergia involuta
Muhlenbergia utilis — M. lindheimeri
Sporobolus cryptandrus — M. schreberi
S. wrightii — Sporobolus asper
S. neglectus

44 genera 59 species

doideae, except in the tribe Sporoboleae, all except one species had the chloroplasts associated with the inner wall. In fact, Badenhuizen *et al.* (1958) stated that the chloroplasts of the parenchyma sheath cells of *Cynodon dactylon* are actually attached to the inner wall.

Among the 9 species of the Sporoboleae, however, chloroplasts occupied an outer position in 4 species but an inner position in 5 species. Although the reason for and significance of chloroplast position is not presently understood, the tribe Sporoboleae is exceptional in having species with both cellular types.

Another character difference between the Sporoboleae and the other tribes of the Chloridoideae was reported by Brown, Pratt, and Mobley (1959). The Chloridoideae in general are characterized by having both a sheath pulvinus and a culm pulvinus but the Sporoboleae typically lack the culm pulvinus. However, both of these characters, chloroplast position and type of pulvinus, are not clear-cut. Although all examined Sporoboleae lack the culm pulvinus, a few species in other tribes of the Chloridoideae lack it also; and although, with one exception, all of the examined Chloridoideae, except Sporoboleae, have centripetally-located chloroplasts, among the Sporoboleae the plastids

are centrifugally located in about as many species as have them located centripetally. The evidence is interpreted as indicating that the Sporoboleae are only slightly atypical Chloridoideae, but they constitute the only tribe of that natural alliance that possess even this much difference. The other tribes, except for spikelet and inflorescence morphology, are quite uniform among themsleves for many recently-discovered characters.

The difference in position within the parenchyma sheath cells of starchless chloroplasts of the Eupanicoideae and the Chloridoideae is probably correlated with the physiological activities and submicroscopic structures of the chloroplasts in the two groups. Parenchyma sheath cells of the Eupanicoideae are pale green, probably carry on little photosynthesis, have chloroplasts (in *Zea mays* at least) devoid of grana (Vatter, 1955; Hodge *et al.*, 1955), and store large amounts of starch, the sugar having come from the dark green actively photosynthetic mesophyll that does not store starch (Rhoades and Carvalho, 1944). In contrast, the parenchyma sheath cells of the Chloridoideae are dark green, actively photosynthetic, and store starch (Brown, 1959). The cells external to the parenchyma sheath are pale green having few chloroplasts. The chloroplasts of the parenchyma sheath cells of the Chloridoideae both store starch and are photosynthetically active; those of the Eupanicoideae store starch but are at most only slightly photosynthetically active since they have no grana. It can be predicted that the submicrosopic structure of the parenchyma sheath chloroplasts of the Chloridoideae are likely to be different from those of the Eupanicoideae since structure and function generally are correlated. The submicrosopic chloroplast structure as revealed by electron microscopy is presently being investigated in a number of taxonomic groups of the Gramineae.

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MEIOTIC CHROMOSOME NUMBERS IN TEXAS SPECIES OF THE GENUS *COREOPSIS* (COMPOSITAE-HELIANTHEAE)

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ABSTRACT. Meiotic chromosome counts for 8 taxa, 7 species and 1 variety, of the genus *Coreopsis* are reported. These include the following: *C. basalis* var. *basalis* (n=13), *C. basalis* var. *wrightii* (n=13), *C. cardaminefolia* (n=12), *C. lanceolata* (n=13), *C. linifolia* (n=13), *C. nuecensis* (n=9), *C. pubescens* (n=14), and *C. tinctoria* (n=12).

In several instances these counts differ for those previously reported for the taxa. Meiotic configurations in *C. nuecensis* showed apparent ring structures which appeared to be constant for the several plants examined. On the basis of existing information it seems likely that the ancestral base of the genus is x=12 or 13.

The genus *Coreopsis*, which includes approximately 100 species, is composed of annual and perennial herbs (rarely shrubby) with a predominately subtropical distribution in North America, South America and Africa. It includes a number of cultivated ornamentals, but otherwise the genus is of little economic importance.

Thirteen species of this genus have been accredited to Texas by the only recent monographer (Sherff, 1955). In the present paper chromosome counts for eight taxa, 7 species, and one variety, are reported (Table 1).

Chromosome counts were made from pollen mother cell squashes. Buds were collected from plants growing in the field and placed in a freshly mixed solution of 4 parts chloroform: 3 parts absolute alcohol: 1 part glacial acetic acid and allowed to remain for a period varying from several hours to several weeks. Young anthers were subsequently removed and squashed in acetocarmine. Camera lucida drawings were made at an initial magnification of ca. 2,000 diameters.

Chromosome counts of $2n = 26$ for *C. basalis* were previously reported by Gelin (1934; as *Coreopsis drummondii*). He also listed the chromosome number of *C. cardaminefolia* as $2n = 26$. This latter count does not agree with the base number of 12 reported in the present paper. Unfortunately Gelin examined garden material of this species and did not voucher his collection so that one cannot be sure of the species with which he worked. Bilquiz (1951; according to Darlington

TABLE 1

Species of Coreopsis examined for chromosome numbers

Species	Voucher Collection	*n* number
Coreopsis basalis (Otto & Dietr.) Blake var. basalis	TEXAS. Bastrop Co. Turner 3806a	13
Coreopsis basalis (Otto & Dietr.) Blake var. basalis	TEXAS. Bexar Co. Turner 4542	13
Coreopsis basalis (Otto & Dietr.) Blake var. basalis	TEXAS. Colorado Co. Turner 3825	13
Coreopsis basalis (Otto & Dietr.) Blake var. basalis	TEXAS. Fort Bend Co. Turner 3823	13
Coreopsis basalis (Otto & Dietr.) Blake var. basalis	TEXAS. Gonzales Co. Thompson & Graham 24	13
Coreopsis basalis var. wrightii (Gray) Blake	TEXAS. Burnet Co. Turner & Johnston 2460	13
Coreopsis cardaminefolia (DC) Nutt.	TEXAS. Bee Co. Thompson & Turner 45	12
Coreopsis cardaminefolia (DC) Nutt.	TEXAS. Kinney Co. Turner 3878	12
Coreopsis cardaminefolia (DC) Nutt.	TEXAS. Kenedy Co. Turner 4473	12
Coreopsis lanceolata L.	TEXAS. Galveston Co. Turner 4353	13
Coreopsis lanceolata L.	TEXAS. Liberty Co. Turner 3745	13
Coreopsis lanceolata L.	TEXAS. Walker Co. Turner 4390	13
Coreopsis linifolia Nutt.	TEXAS. Hardin Co. Turner 4616	13
Coreopsis nuecensis Heller	TEXAS. San Patricio Co. Turner 4465	9 (7^{II}, ⊖4)
Coreopsis pubescens Ell.	OKLAHOMA. Murray Co. Turner 4530	14
Coreopsis tinctoria Nutt.	TEXAS. Llano Co. Turner & Johnston 2494	12

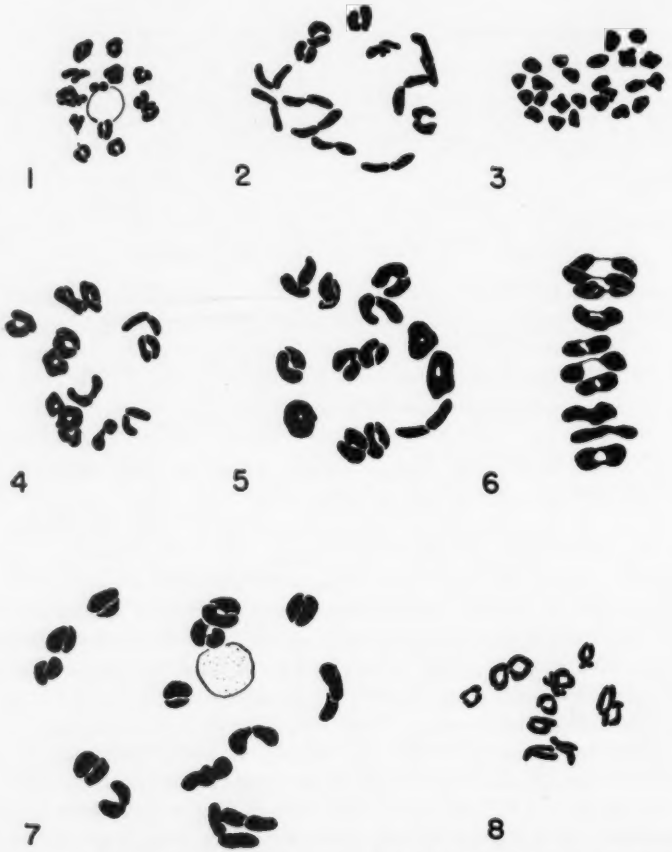
and Wylie, 1956, but without listed reference) also reported *C. cardaminefolia* to have a base number of 12.

Coreopsis lanceolata was reported by Bilquiz (*fide* Darlington & Wylie, 1956) to have a base number of $n = 12$. This does not agree with the counts obtained from Texas material which are on a base of $n = 13$. To my knowledge Bilquiz has not published his work so that it is not possible to know from what material he obtained his counts.

The chromosome count of $n = 14$ for *C. pubescens* agrees with a previously reported count for this species by Snoad (1952 *in* Darlington and Wylie, 1956; original reference not examined), *C. tinctoria* was reported by Gelin (1934; as *Coreopsis bicolor*) to have a chromosome base of 12; this is also true of the Texas material of the species.

Counts of $n = 13$ and $n = 9$ (7 II, ring of 4) for *C. linifolia* and *C. nuecensis* have not previously been reported. The latter count is particularly interesting, since the ring configurations are apparently constant for a number of plants and in populations far removed from the count documented here.

Only 10 species of the approximately 100 species of the genus *Coreopsis* have been investigated for chromosome number. Base numbers of $x = 14$, 13, 12 and 9 have been established for the various species, the numbers 13 and 12 being most common. Counts of $n = 14$ and $n = 9$ have been found for only two species, *C. pubescens* and *C. nuecensis*; the former is a rather widespread perennial of the central U.S. and the latter is a fairly restricted annual of southern Texas.



Figures 1–8. Meiotic chromosomes of Coreopsis. Fig. 1. C. *basalis* var. *basalis* (n=13). Fig. 2. C. *basalis* var. *wrightii* (n=13). Fig. 3. C. *cardaminefolia* (n=12); metaphase of second division. Fig. 4. C. *lanceolata* (n=13). Fig. 5. C. *linifolia* (n=13). Fig. 6. C. *nuecensis* (n=9; 7 II and ring of 4). Fig. 7. C. *pubescens* (n=14). Fig. 8. C. *tinctoria* (n=12).

In view of the relatively few species of *Coreopsis* which have been examined, it is not unlikely that additional new counts will be found. In the much smaller, but closely related genus *Thelesperma* base numbers of 12, 11, 10, 9 and 8 have been found (Turner, unpubl.). As to the probable ancestral base number of the genus very little can be said. However, of the 20 genera recognized by Hoffman (1894) in the natural subtribe Coreopsidinae, 9 have chromosome counts reported for them. Five of the 9 genera have species with $n = 12$ (*Bidens*, *Cosmos*, and *Calyptrocarpus* so far as known, exclusively so). Two of the genera are on a base of $x = 15$ (*Guizotia* and *Hidalgoa*); one on a base of $x = 11$ (*Heterospermum*); and *Dahlia* with base numbers of $x = 16$ and 18.

If, on geographical and numerical grounds, 12 is assumed to be the ancestral base chromosome number for the genus *Coreopsis* then it is obvious that aneuploid changes have occurred in both directions. A more inclusive investigation of the species, particularly those from other continents, is needed before appropriate speculation can be made.

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NOTEWORTHY RECORDS OF SKINKS (GENUS *EUMECES*) FROM NORTHWESTERN MEXICO

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ABSTRACT. Distributional records and taxonomic notes are presented for the following seven species of rare or little-known skinks from the Mexican states of Chihuahua and Durango: *Eumeces brevirostris bilineatus*, *E. callicephalus*, *E. lynxe durangoensis*, *E. multilineatus*, *E. multivirgatus*, *E. obsoletus*, and *E. parviauriculatus*. *E. lynxe durangoensis* Tanner is a junior synonym of *E. lynxe belli* (Gray). *E. multivirgatus mexicanus* Anderson and Wilhoft is probably a junior synonym of *E. multilineatus* Tanner.

In the collections of reptiles and amphibians made in northern Mexico by summer field expeditions of the University of Kansas Museum of Natural History since 1955, there are some noteworthy specimens of scincoid lizards from Chihuahua and Durango.

EUMECES BREVIROSTRIS BILINEATUS Tanner. Data for five specimens from Chihuahua are as follows: KU 44262–3, 15 mi. S and 6 mi. E Creel, 7300 ft., July 16, 1957, and KU 47429, 2 mi. W. Samachique, 7000 ft., July 11, 1958 (juveniles); and KU 51324–5, 2 mi. W. Samachique, 7000 ft., July 11–12, 1958 (adults). The five specimens provide additional information on variation in this recently described subspecies and extend its known range slightly eastward in Chihuahua.

The juvenal specimens differ from two juvenal paratypes of *bilineatus* (KU 44728 and 44730) from the region of El Salto, Durango (paratype from Mojarachic, Chihuahua, not examined), as follows: markings on anterior part of body having greater contrast; dorsolateral lines paler and wider, most distinct anteriorly but easily discernible to insertions of hind limbs; dorsal field between pale lines uniformly metallic, tannish gray (more evident in specimens from Creel than specimen from Samachique); tail bright blue; a distinct, wide, dark stripe on side of body, bordered above by pale dorsolateral line and below by silverish color of belly. Colors of the two adults fall within the range of variation seen in the holotype and four adult paratypes (KU 44726–7, 29, 31–32). One of the adults from Samachique (KU 51324) was giving birth to young when caught;

KU 47429 is a specimen from this litter. A fully developed fetus remains in the uterus of the female.

Measurements (mm.) and pertinent characters of squamation (given in the order that specimens are listed above) are as follows: snout-vent length 28, 29, 26, 56, 54; length of tail (for KU 44262 and 51324, respectively) 37, 57; dorsal scales (hereinafter from parietals to above anus) 58, 58, 53, 57, 59; scale-rows at midbody 24, 24, 22, 24, 24; seven supralabials; seven infralabials; one postmental; postnasals lacking; prefrontals separated; parietals meeting behind interparietal; primary temporal fused with upper secondary temporal in four specimens (these scales not fused in KU 51325).

EUMECES CALLICEPHALUS Bocourt. An adult female (KU 51462) was obtained on July 21, 1959, 3 mi. NE Temores, 5600 ft., Chihuahua. To our knowledge, this is the third specimen of the species from Chihuahua. Taylor (1935:298) listed a specimen from Madera, and Taylor and Knobloch (1940:127) recorded one specimen from Mojarachic [see also Taylor (1943:273, 275)].

The KU specimen has the following characteristics: snout-vent length 57 mm.; length of tail (regenerated) 54 mm.; dorsal scales 57; scale-rows at midbody 28; supralabials, as well as infralabials, seven; sixth and seventh supralabials subequal; one postlabial; two postmentals; two pairs of nuchals; parietals not enclosing interparietal; prefrontals in contact; a small postnasal on right side; digits overlapping when limbs adpressed; a dim pale line beginning medially on neck, bifurcating at juncture of nuchals and interparietal, and reuniting on rostral; dorsolateral lines narrow, whitish, disappearing approximately six scales posterior to insertions of arms; dorsal field brownish, occupying six and two half-scale rows; sides of body blackish brown.

Considering the high degree of variation in this species (as noted by Taylor, 1935:290–298), the most notably divergent characters of the KU specimen are the contact of interparietal and nuchals, overlapping adpressed limbs, and the presence of a small postnasal (right side only) in contact only with first supralabial (not with supranasal).

EUMECES LYNXE DURANGOENSIS Tanner. On June 30 and June 31, 1955, Webb and Charles M. Fugler collected a skink 30 mi. E of El Salto, Durango (KU 44737) and three skinks 10 mi. E of El Salto (KU 44734–6). These specimens were dsecribed by Tanner (1958: 57–59) as *Eumeces lynxe durangoensis*.

The junior author has begun a study of the relationships of Durangan skinks and, to date, has seen 19 specimens of this subspecies from Durango and Zacatecas. There is an earlier name available for this

subspecies. A paper by Smith and Etheridge (1953) convinces us that the above-mentioned specimens represent *Plestiodon belli* Gray. Dr. Hobart M. Smith has seen some of our specimens and concurs with our identification. The name, *Eumeces lynxe durangoensis* Tanner 1958, is therefore a junior synonym of *Eumeces lynxe belli* (Gray) 1845.

EUMECES MULTILINEATUS Tanner. A single adult female (KU 44261) was obtained 15 mi. S and 6 mi. E Creel, 7300 ft., Chihuahua, on July 13, 1957; the specimen agrees with the detailed original description by Tanner (1957:111–112) and with the half-tone reproduction of a Chihuahuan specimen (USNM 30833, now a paratype of *multilineatus*) presented by Taylor (*op. cit.*: 599, pl. 28, fig. 3). The KU specimen extends the known geographic range of *E multilineatus* some 130 miles south-southeastward from Chuhuichupa, the type locality.

In a recent paper, Anderson and Wilhoft (1959) described a new skink, *Eumeces multivirgatus mexicanus*, from Yaguirachic, a locality a few miles southeast of the type locality of *E. multilineatus* Tanner. Their description and illustration of *mexicanus* agree generally with that of Tanner for *multilineatus* and with the KU specimen of *multilineatus*. The resemblance of *mexicanus* and *multilineatus* and the close proximity of their type localities suggest that *mexicanus* is a direct synonym of *multilineatus*, but we have not examined specimens of *mexicanus*.

EUMECES MULTIVIRGATUS ssp. A juvenile (KU 44260) was obtained 23 mi. S and 1½ mi. E Creel, Chihuahua, on July 20, 1957. In view of the foregoing remarks concerning *E. multilineatus*, KU 44260 probably constitutes the first Mexican record of *E. multivirgatus*. Characters of scalation that tend most to ally the specimen with *multivirgatus* are given in the first sentence of the brief description below.

Scale-rows at midbody 25; supralabials 7–7; infralabials 6–6; two postmentals; a postnasal present on each side; prefrontals in contact. Parietals in contact behind interparietal; primary temporal fused with upper secondary temporal on left side (these scales not fused on right side); snout-vent length 29 mm.; dorsal scales 57. Dorsum grayish from shoulders to base of tail, each scale having metallic gray center and pale tan edge; belly silver-gray; chest, throat, and lips cream; top and sides of head dark brown; dark color on side of head continuous with brown stripe along side of body to insertion of hind limb, stripe on fifth and adjacent halves of fourth and sixth scale-rows at midbody; anterior half of lateral dark stripe bordered above and below by white lines, one originating on anterior supraocular and the other at ear;

both white lines wanting on posterior half of body; a middorsal white line beginning at level of shoulders and running anteriorly, on adjacent one-fourths of two middle scale-rows, to nuchals where it bifurcates, each branch running forward to rostral.

On the neck there is a suggestion of a dark line on either side of the middorsal line and on the medial side of the dorsolateral pale lines, but these dark lines become obscure at the level of the shoulders. The darker centers of the dorsal scales tend to create an obscure, many-lined pattern when the specimen is viewed in liquid. The general coloration of the specimen is remarkably like that of *Eumeces callicephalus*.

The taxonomic status of the population near Creel cannot be decided until a series of specimens, including adults, has been collected.

EUMECES OBSOLETUS (Baird and Girard). A juvenile (KU 51323) was found in a vegetation-clogged hoopnet when the net was removed from a shallow drainage ditch 1 mi. N Guadalupe Victoria, Chihuahua, on June 27, 1959. The grassy banks of the ditch were interrupted at intervals of a hundred feet or more by dense wood thickets. A brief search of the immediate area failed to produce other specimens. The KU specimen agrees with the color description given by Taylor (*op. cit.*: 313) for juveniles of this species. In characters of scalation the KU specimen differs in no significant respect from juveniles of comparable size from Meade and Marion Counties, Kansas. Measurements of the Chihuahuan specimen are as follows: snout-vent length 37 mm.; length of tail 27 mm. (tip missing). The KU specimen constitutes the second record of *E. obsoletus* from Chihuahua, the only other being a specimen in the National Museum from Chihuahua City (Taylor, *op. cit.*: 320). Guadalupe Victoria is approximately 50 miles southeast of Chihuahua City.

EUMECES PARVIAURICULATUS Taylor. Two specimens (KU 51463–4) were obtained 3 mi. NE Temores, 5600 ft., Chihuahua, on July 20 and 21, 1959. This species has been known heretofore from Alamos, Sonora (holotype only—Taylor, 1933: 178–181) and from two specimens obtained at Mojarachic, Chihuahua (Taylor and Knobloch, *op. cit.*: 128). The KU specimens extend the known range of the species approximately 45 miles south-southwestward from Mojarachic and a nearly equal distance east-northeastward from Alamos. It seems probable that the species will eventually be taken in northern Sinaloa and northwestern Durango.

Data on scalation and bodily proportions for KU 51463 (an adult female, as determined by dissection) and 51464 (a juvenile of undetermined sex), respectively, are as follows: snout-vent length 39, 26; tails

broken; dorsal scales 65, 64; scale-rows at midbody 19, 20. In other characters, the specimens agree with the type description.

Ground color of dorsum purplish dark brown, dark centers and pale borders of scales forming obscure pattern of two dark and three pale lines; sides of head and body blackish brown; a pale stripe from rostral, along side of body (first on adjacent thirds of second and third scale-rows and then on center of third row) to base of tail (to midbody in adult); pale stripe limits dark lateral coloration dorsally; a continuous, nearly immaculate (slightly speckled in adult) pale area on throat and chest, including rostral and first five supralabials; a seperate pale stripe from fifth supralabial to shoulder (to ear in adult); a pale line from anterior supraocular along all but posteriormost part of supraocular border (deficient in adult); belly dark silvery gray, having four darker, longitudinal stripes, each on center of scale-row (stripes more distinct in adult); tail bluish gray. The foregoing description of pattern is based mainly on the juvenal specimen. Pattern of the adult is obscured by melanin. Pale areas on the juvenile are white to cream whereas those of the adult are no paler than silvery gray.

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THE TAXONOMIC STATUS OF OKLAHOMA BEAVERS, *CASTOR CANADENSIS**

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ABSTRACT. Study of the skulls of Oklahoma beavers and comparison with specimens from Texas and Kansas shows that individuals from the Red River drainage are referable to *Castor canadensis texensis*, those from the Arkansas River drainage to *C. c. missouriensis*.

Local names, such as Beaver River, common knowledge among old settlers, and occasional records such as those of Chouteau's trading post, all attest to the fact that at one time beaver were widespread in Oklahoma. Indiscriminate trapping led to their decimation without specimens from early years being deposited in museums. Blair (1939) was unable to cite specimens in his extensive survey of Oklahoma mammals. He cited two literature references to beaver by Snider (1917) and Marcy (1854), and reported some old tree cuttings seen at Wekiwa on the Arkansas River west of Tulsa sometime prior to 1939. In his opinion beaver, at the time of writing, were almost or completely extirpated from the State. Duck and Fletcher (1943), however, noted that the bulk of Oklahoma's beaver population occurred on the Washita and North Canadian Rivers, with other colonies in Atoka, Pushmataha, and Pawnee counties. In the absence of specimens, Blair postulated that the beaver of eastern Oklahoma might be referable to the subspecies *carolinensis*, and that of western Oklahoma to *texensis*. McCarley (1952) recorded two colonies of *C. canadensis* from Bryan County, but did not allocate them to subspecies, as the animals themselves were not critically examined. Hall and Kelson (1958) indicated that the beaver of the northern one-fourth Oklahoma (including the panhandle) should belong to the subspecies *missouriensis* and those from the remainder of the State, including McCarley's record, should be *texensis*. They referred the beaver of the South Canadian River in Texas to the subspecies *texensis* on the basis of a reference by Bailey (1905). However, examination of Bailey's original comment reveals that he was quoting a report by Howell (evidently an oral account as no reference is cited) that beaver oc-

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curred there. There is no implication in the original text that it was Bailey's intent to assign the Canadian River beaver to the race *texensis*.

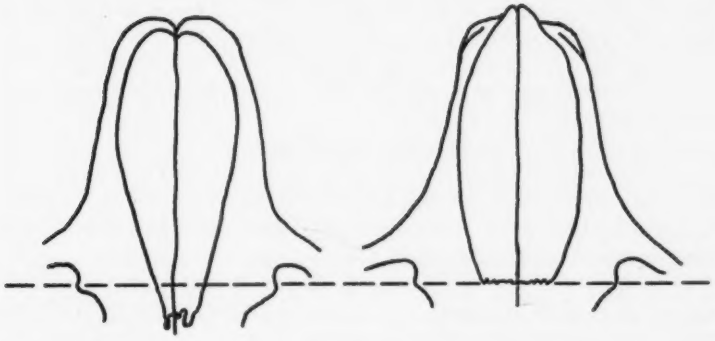
In 1951 the State Game and Fish Department undertook as a federal aid project a survey of the beaver population of Oklahoma, which continued until 1953. The survey, conducted by Glenn E. Jones, established the existence of over 1200 beaver in Oklahoma with some present in nearly every section of the State. The largest concentration was in the west. As a part of the survey, a number of skulls were collected, in the hope that exact determination of the races of beaver in Oklahoma might be made. These skulls are now in the Oklahoma State University Museum, and are the subject of this report.

The material available consists of 13 specimens, from juveniles to old adults, all but one from the western half of the State. One was from the vicinity of McAlester, but may have been transplanted there from elsewhere. Since there are no records of transplantations of beaver into the western part of the State, it is assumed that these specimens represent native stock. For the loan of material to compare with the Oklahoma specimens the writer is indebted to Dr. W. B. Davis of the Agricultural and Mechanical College of Texas for eight typical *C. c. texensis* from Edwards and Kimble counties, Texas, and to Dr. E. R. Hall of the University of Kansas Museum of Natural History for sixteen typical *C. c. missouriensis* from Cheyenne, Clay, Douglas, Leavenworth, Pottawatomie, and Riley counties, Kansas.

Comparison of these two samples has verified several details in the shape and relative length of the nasal bones whereby they may be distinguished from one another, and by means of which Oklahoma specimens may be assigned to one subspecies or the other. The shape of the nasals was an important cranial character used by Bailey in his original description of the race *texensis* and was used by Davis (1940) in his critical comparison of *texensis* and *frondator*.

In *texensis* the greatest width of the nasal bones lies anterior to their midpoint and the bones taper posteriorly to rather narrow points (Fig. 1A). In *missouriensis* the greatest width of the nasals lies at their midpoint and their lateral borders curve evenly forward and backward from that point, to give their combined outline an oval appearance. Their posterior borders are rather abruptly truncate (Fig. 1B). In *texensis* the posterior extremities of the nasals extend backward well past the level of the antorbital (lacrymal) processes of the frontal (Fig. 1A), while in *missouriensis* the truncated ends of the nasals lie in the same plane as the antorbital processes (Fig. 1B).

In these characteristics the beavers of the Red and Washita Rivers



A. B.

Fig. 1. Outlines of the nasal bones of two subspecies of beaver. The dotted line passes through the antorbital processes of the frontal bones.

A. *Castor canadensis texensis* from Edwards County, Texas.

B. *Castor canadensis missouriensis* from Douglas County, Kansas.

conform to the race *C. c. texensis*, while those of the Cimarron and North Canadian River systems conform to the characteristics of *C. c. missouriensis*.

Unfortunately, information on such subspecific characteristics as tail shape and pelage color are not available, and this study must, therefore, be based exclusively on cranial characters. However, on the basis of the information available from the material at hand, it seems that in Oklahoma the Missouri River beaver (*C. c. missouriensis*) occupies the area of the State that lies within the Arkansas River basin, while the Texas beaver (*C. c. texensis*) is restricted to the Red River Basin.

Intergradation may occur within the long narrow basin of the South Canadian or across its divide with the Washita River. On the other hand both *texensis* and *missouriensis* may have integraded independently with *C. c. carolinensis* to the east and *frondator* and *concisor* respectively to the west, with little direct gene exchange taking place between them. Considering the aridity of the Great Plains and the linear character of beaver habitat within them, the latter postulate seems most likely. Absence of tangible evidence of intergradation between the two in Oklahoma seems to bear this out.

Transplanting of beaver from western Oklahoma to the eastern part of the State without regard for the natural boundaries of native races probably will result in a hybrid population whose affinities will not be determinable with certainty. Records of restocking under the federal

aid program indicate that attempts have been made to reestablish beaver in both drainage basins in the eastern part of the State. The source of stock for these plantings is not included in the records.

SPECIMENS EXAMINED

Kansas 16; Cheyenne County, St. Francis, 1; Clay County, Clay Center 7; Douglas County, 1, 5 miles north of Lawrence, 1, ½ mile north of Lawrence, 1, 3 miles south-southeast of Lawrence, 1; Riley County, 1, Manhattan, 1; Leavenworth County, near Leavenworth, 1; Pottawatomie County, Wamego, 1.

Oklahoma 13; Beaver County, 1; Caddo County, Cobb Creek, 1; Canadian County, El Reno, 1; Cherokee County, Aline, 1; Cotton County, Beaver Creek, 1, 5 miles south of Waurika, 1, mouth of Cache Creek, 1; Ellis County, 1; Johnston County, near Tishomingo, 1, Lake Texoma, 1; Oklahoma County, Lake Overholser, 1; Pittsburg County, near McAlester, 1; Texas County, 1.

Texas 8; Edwards County, near Telegraph, 1, 7 miles south Telegraph, 1, 9 miles south Telegraph, 1; Llano River, 1; Kimble County, 3 miles south Junction, 1, 9 miles south Junction, 1; Segovia, 1, 8 miles south Segovia, 1.

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TAXONOMIC NOTES ON ARIZONA HERPETOZOA*

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ABSTRACT. This is a report of various amphibians and reptiles from Arizona, in the Museum of Natural History, University of Illinois, that are of taxonomic interest. Of special importance are: a new character for *Sceloporus undulatus virgatus*; variation in *Urosaurus ornatus schotti* (=*linearis*) with comments on the status of *U. o. symmetricus*; review of diagnostic characters and ranges of *Cnemidophorus tigris gracilis* and *C. t. aethiops*.

Distributional records and taxonomic data of Arizona amphibians and reptiles in the collection of the Museum of Natural History of the University of Illinois are reported herein. Thanks are due to Dr. Donald F. Hoffmeister, of the Museum, and Dr. Hobart M. Smith for permission to study the Museum material and for reading the manuscript; to Pete S. Chrapliwy for his comments on the manuscript; and to Dr. Laurence Klauber for help on several problems concerning the rattlesnakes of southern Arizona. Most of the Arizona material in the Museum was acquired through the efforts of Dr. Hoffmeister and student aides during the course of summer field trips financed by the Museum of Natural History.

Most localities may be found on state highway maps of Arizona; others are indicated on the U. S. geological topographical maps. All color notes are in reference to preserved material unless otherwise stated. All specimens unless otherwise noted are in the Museum of Natural History, University of Illinois.

Ambystoma tigrinum nebulosum Hallowell. A juvenile (31348) 4 mi. NE Hannigan Meadows, Greenlee Co.; total length, 87 mm., tail 36 mm.; no external gills; dorsolateral marbled yellow lines, broken on posterior part of head; tail with yellow bars. Calef (1954:223) reported 2 adults from this area, one in UIMNH (33819).

Ambystoma tigrinum utahense Lowe. Two adults (35914–15) from Neal Spring, north rim Grand Canyon National Park; three (including a larva) from Swamp Lake, and an adult from Hearst Ranch Tank, all in the Park, Coconino County.

Spea intermontanus (Cope). Three (38640–42), Wolf Hole, Mohave County; a large glandular lump between eyes; dorsal rugosities

* Contribution of the Museum of Natural History and Dept. of Zoology, University of Illinois.

primarily lateral; body color light gray with indication of dorsolateral white stripes.

Bufo microscaphus microscaphus Cope. One (38625), 15 mi. SE Kingman, Mohave County, and six (2430–35) from Flagstaff, Coconino County.

Hyla arenicolor Cope. Two (35817, 35819), 3 mi. SW Tumacacori, Santa Cruz County.

Rana tarahumarae Boulenger. Four adults (35885–88), 3 mi. SW Tumacacori (Tinaja Canyon), Santa Cruz County. Identified by the inconspicuous tympani, poorly defined dorsolateral folds, and dusty colored venter and throat.

Rana catesbeiana Shaw. A large adult (38637), 3½ mi. SE Gadsden, Yuma County.

Terrapene ornata luteola Smith & Ramsey. Two (24537–38), 1 mi. WNW Stockton Pass, and 6 mi. NW Bonita, respectively; one (31349), 1½ mi. SW Fort Grant, all in Graham County.

Holbrookia texana scitula Peters. An adult (38710) on Harquahala Mountains, 10 mi. E Wenden, Yuma County, extends the known range approximately 75 miles westward. It agrees with Peters' (1951: 8) diagnosis of the subspecies; ventrals 86; dorsal head scales (using Peters' method of counting, *op. cit.*:) 48; femoral pores 35.

Holbrookia maculata approximans Baird. One (38714), 15 mi. ESE Kingman, Mohave County, and one (43212), 9 mi. E, 1 mi. S Topawa, Pima County.

Sceloporus undulatus elongatus Stejneger x *u. tristichus* Cope. Six (27964–69) from the Grand Canyon National Park, Coconino County, show strong *elongatus* characteristics. Three (with 43, 44 (2), dorsals) have fewer than 45 dorsal scale count listed by Smith (1939:173) as being the key separation point for *elongatus* (45 or more) and *tristichus* (less than 45); the other three counts are 48, 48, 49. Dorsal cross-marks range from none in three specimens, faint in one, to well defined in two. Scales around body are as follows: 49 (2), 47 (1), 51 (1), 52 (1), and 53 (1); femoral pores 17 (1), 16 (1), 18 (2), 19 (1), 20 (1); scales between femoral pores 5 (1), 6 (3), 7 (2).

Sceloporus undulatus tristichus Cope. Eight (38643–50) from Mohave County: Road to Democrat Mine, 15 mi. ESE Kingman (5); 5 mi. SSE Wolf Hole (2); and Telluride Chief Mine, 15 mi. SE Kingman (1). Dorsal scale counts 38 (2), 39 (3), 40 (1), 42 (2); scales around body 41 (1), 42 (1), 43 (2), 44 (1), 45 (2), — (1); femoral pores 13 (1), 14 (2), 15 (3), 16 (3), 17 (2), 18 (2), 19 (2), 20 (1); scales between femoral pores 4 (1), 5 (2), 6 (3), 7 (1). Four specimens show a juvenile pattern of dorsolateral white longitudinal

lines; three show faint dorsal dark markings; and one has no pattern. These represent additional records for Mohave County, in addition to Duellman's report (1955: 8) which represents the western extremities of the known range.

Sceloporus undulatus virgatus Smith. A female (41236) near Crystal Cave, 4 mi. W Portal, Chiricahua Mountains, Cochise County. A slight purplish tinge to lateral areas of belly, but no distinct blotch; a distinct dark band under lateral light band; femoral pores 25; scales between femoral pore rows 5. The femoral pores of this specimen and of two others from Mojarachic, Chihuahua, are notched posteriorly. No *Sceloporus undulatus consobrinus* or *S. u. tristichus* were found with the same form of pore scales. However, this character is so unusual that larger series of *virgatus*, especially from areas of possible intergradation with *consobrinus*, must be examined before the significance of the character can be assured.

Urosaurus ornatus schotti Baird. The author follows Langebartel and Smith (1954: 130–132) in applying the name *schotti* to the population formerly called *linearis*. I also follow Murray (1953) and Duellman (1955: 8) in not considering *Urosaurus o. chiricahuae* as a recognizable race.

Sixty-one specimens examined do not adhere closely to Mittleman's (1942: 137–139) diagnosis of *linearis* in regard to the prefrontals, frontonasals (characters used to separate it from *symmetricus*), and size of inner and outer rows of paravertebrals (used as a diagnostic character to separate the Sonoran population ("*schotti*") from the Arizonan population ("*linearis*"). In *linearis* Mittleman (*op. cit.*) states there are typically 2 prefrontals, 5 frontonasals (3 each in *symmetricus*), and paravertebral rows nearly equal in size (inner paravertebral row larger than outer in "*schotti*").

Table 1 casts some doubt on the distinction of the subspecies *symmetricus* from *schotti* on the basis of prefrontals and frontonasal scale differences; however due to lack of material from areas within the range of *symmetricus* for a consideration of other possible diagnostic characteristics (*e.g.*, vertebral width, size, habitat differences), the question cannot at present be adequately investigated. One of the two Yuma specimens does have a vertebral width greater than that of the widest paravertebral scale, characteristic of *symmetricus*. If *symmetricus* is recognizable, then the range as shown by Stebbins (1954: 321) is in error, as the Pima and Maricopa County specimens examined belong to *schotti* (*linearis*). The map of Smith (1946: 496) is probably more correct, as it shows Yuma County as an intergrading area with the major part of the range in the Colorado River Valley,

TABLE 1

Prefrontals (PF), frontonasals (FN), and relative size of paravertebral rows (PV), in Urosaurus ornatus schotti.

County[1]	PF			FN			PV		Total Specimens
	2	3	4	3	4[2]	5	+[3]	e[3]	
Mohave	1	.	.	1	.	.	1	.	1
Yuma	1	1	.	2	.	.	2	.	2
Coconino	1	1	1	2	1	.	2	1	3
Maricopa	5	2	1	7	.	1	7	1	8
Pima	9	6	1	15	.	1	10	6	16
Santa Cruz	9	4	1	12	1	1	11	3	14
Gila	2	1	.	2	.	1	3	.	3
Cochise	3	3	.	6	.	.	4	2	6
Graham	5	3	.	6	.	2	5	3	8
Totals	36	21	4	53	2	6	45	16	61

1. Counties are listed in relation to their proximity to the range of *symmetricus*, the closest first, etc.
2. This number results from splitting of one lateral frontonasal.
3. Paravertebral rows equal in size (e); inner PV row larger than outer row (+).

southward from the south end of the Grand Canyon and adjacent Nevada and California.

Urosaurus ornatus wrighti (Schmidt). One (35950), mouth of Bright Angel Creek, 2400 ft., Grand Canyon National Park, Coconino County; four enlarged dorsal scale rows (2 on each side of vertebral row) separated by a medial scale row less than width of enlarged dorsal rows; ventral blue blotches not touching in medial line.

Eumeces obsoletus (Baird and Girard). Three adults and two juveniles (6039, 17534, 24514–16): 15 mi. S Fort Huachuca, and 8 mi. W Fort Huachuca, Cochise County; Noon Creek, Graham Mountains, Stockton Pass, and Angle Ranch, Graham Mountains, Graham County. The adults are all typical; the juveniles as described by Taylor (1935: 308) are "black except loreals and temporals."

Eumeces multivirgatus gaigeae Taylor. A young specimen (30290) from Oak Creek Canyon, Coconino County; dark dorsally and ventrally, except for light gular region and under side of limbs; dorsal light stripe forking at region of parietal; two dorsolateral light stripes extending from anterior supraocular posteriorly to level of hindlimbs; lateral stripe from ear to forelegs; supralabials light; postmental undivided; 26 scales around body; snout-vent 40 mm.; tail (regenerated at tip) 41 mm.

It has the character given by Maslin (1957: 89) for Utah *gaigeae*: "the posterior point of the labial border of the seventh supralabial lies exactly opposite the posterior point of the labial border of the last

infralabial." It differs from Maslin's illustration (*loc. cit.*, fig. 1E, p. 88) in having 1½ scale rows instead of 2 between the medial and dorsolateral stripes.

Cnemidophorus stictogrammus Burger. Two (46764–5), 9 mi. E, 1 mi. S Topawa, and 3 mi. S, 4½ mi. E Topawa, Pima County; both apparently young, 80 mm. and 74 mm. snout-vent lengths. They fit the diagnosis for *stictogrammus* in having occipital-rump scale counts 215 and 220. However, they fall into an intermediate class in number of scales around body (excluding ventrals), having 88 and 85, whereas Lowe (1956: 140) gives the range for *stictogrammus* as 98–115 and for *sacki exsanguis* as 62–82. However, Zweifel (1959: 100) lists specimens of *stictogrammus* from Sonora with as few as 91 scales around midbody. The number of scales between paravertebral stripes is intermediate, 6 in both specimens. The circumorbital semicircles do not reach the frontal as indicated by Lowe (*op. cit.*, p. 143) for his series of *strictogrammus*.

Cnemidophorus tigris gracilis Cope. The *tigris* of southern Arizona have been treated by numerous authors in several ways. Smith and Taylor (1950: 355) restricted the type locality of *t. gracilis* to Yuma, Yuma County, Arizona. If this is accepted, the type specimen may be an intergrade with the nominal subspecies *tigris*. There seems to be no reason to reject this restriction, especially since the characters of the type fall within the range of those of the series from Yuma County (see below). Burt (1931: 153) states of *gracilis*: "The type is a young desert specimen with a slaty throat and with considerable blackish suffusion below, and is indistinguishable from the young of what has been called *melanostethus* by Cope. There are traces of six stripes on the body instead of four as stated in the original description, but those on the back are only slightly irregular." However, Burt (*op. cit.*) placed *gracilis* in the synonymy of *Cnemidophorus tesselatus*.

Smith (1946: 424–426) regarded the southeastern Arizona population as *t. aethiops*. Duellman (1955: 9–10) states that specimens from the Tucson area west to Ajo, Pima County, have jet-black chests and refers them to *t. aethiops* apparently inferring that *t. gracilis* is not black chested. He regarded *Cnemidophorus melanostethus* Cope as a *nomen dubium*, but this referral is questionable since the type is available. Cope (1863: 104) gave the type locality of *melanostethus* as "Region of the Colorado of California" and this was later restricted by Smith and Taylor (*loc. cit.*) to Yuma, Yuma Co., Arizona. Accepting the type locality restriction of *melanostethus* I am considering this name a junior synonym of *C. t. gracilis*.

Burger (1950: 6) neglected to mention the black or slaty chest of

gracilis, but listed it as a diagnostic characteristic of *aethiops*. The type of *gracilis* (fide Burt, *loc. cit.*) is dark chested. Smith and Taylor in the Mexican Checklist (1950: 177) recognize *gracilis* as a black chested race.

In an attempt to clear up the confusion between the subspecies *C. t. aethiops* and *C. t. gracilis* I have examined all available UIMNH specimens (102) from southern Arizona and Sonora, Mexico. The following discussions pertain to that series.

Localities. (all UIMNH specimens): *C. t. gracilis* (50 specimens) *Pima County*: 4 mi. NW Greaterville; 3 mi. SW Hickiwan; 3 mi. W Vaya Chin, Sycamore Canyon, 8.5 mi. E, 3 mi. S Topawa; 2 mi. N, 1 mi. E Pisinemo; 5 mi. N Kupk; 9 mi. E, 1 mi. S Topawa; 2 mi. SW Gu Vo; Sabino Canyon Road, 23.5 mi. N, 1 mi. E Sasabe; Bates Well, Organ Pipe Cactus National Monument. *Maricopa County*: 6 mi. SE Wickenburg; 5 mi. SE Wickenburg; 2 mi. S Wickenburg. *Pinal County*: Superstition Mountain. *Yuma County*: Heart Tank, W side Sierra Pinta; 10 mi. E Wenden, N side Harquahala Mountains; 8 mi. W Hope; 15 mi. S, 9 mi. W Hope; 14 mi. S, 5 mi. E Ehrenberg; 2 mi. E Yuma; 12.5 mi. S Yuma.

C. t. aethiops (48 specimens)–*Cochise County*: Keating Canyon, 6 mi. N Paradise. *Sonora*: 13.8 mi. S Santa Ana; 45.1 mi. S Santa Ana; 10.6 mi. S Peon; 2.4 mi. S Empalme; 4 mi. N Navajoa; 14.7 mi. S Empalme; 16.2 mi. N Guaymas.

C. t. gracilis x *aethiops* (4 specimens; possible intergrades not included in table)–*Sonora*: 25.2 mi. E Altar; 1 mi. SE Altar.

Comparisons. *Cnemidophorus t. gracilis* can be separated from *t. aethiops* on the basis of a lower occiput-rump (O-R) scale count and the number of scales around the body (midway between fore and hindlegs, excluding the ventrals). The separation on the basis of O-R counts is 100% (excluding 1 specimen from near Altar, Sonora, considered an intergrade) with the range 134–172 in *gracilis* and 176–225 in *aethiops*. Only 6% (3/50) of *gracilis* O-R counts are greater than 168; 6.1% (3/49) are less than 180 in *aethiops*; the around body scale counts are 60–81 in *gracilis*; 73–91 in *aethiops*; 37.5% of *gracilis* are 73 or more; 60.5% of *aethiops* are 81 or less. Taking the around body scale count of 75 as the separation number for *gracilis*, 8.3% (4/48) are above 75, whereas in *aethiops* 7.9% (3/38) are below 76. Thus the per cent of overlap of both races is 8.1 (7/86). Femoral pores (both sides) in *gracilis* (44) range from 34–46, av. 39.3; *aethiops* (42) from 34–44, av. 38.8. Scales between femoral pore rows are, in *gracilis* (45), 2–5, av. 3.8; *aethiops* (44), 2–5, av. 3.8. Maximum snout-vent measurements (in mm.) 91 in *gracilis* (50), 86 in *aethiops* (48); 46%

(23/50) of *gracilis* exceed 80 mm. snout-vent, whereas only 16.6% (8/48) of *aethiops* do so. Tail length (in mm.): *gracilis*, maximum 268 (SV-86); *aethiops*, maximum 221 (SV-80). No reliance is placed on tail measurements due to large number of specimens with damaged tails and to the difficulty in determining whether the tail is complete, although a real difference may exist.

The dorsal pattern of *gracilis* ranges from 4 wide brown stripes, to a broken pattern of stripes, to a pattern of brown and small white flecks mottled together and completely lacking stripes, as is especially evident in some of the larger specimens. The dorsal pattern in *aethiops* is more constant, normally with 4 narrow white (or light) stripes. The lateral areas of *gracilis* are composed of white blotches interspaced by a dark pigment but are a more uniform dark color in *aethiops*. The ventrum of *gracilis* varies from dark throat and chest with belly scales heavily flecked with black to specimens with throat not so heavily pigmented. The chest is nearly always dark. *Cnemidophorus t. aethiops* is dark over the entire ventrum, with the black pigment reaching just anterior to insertion of hindlegs.

C. t. tigris differs from *gracilis* and *aethiops* in the following characters: 4 relatively wide light stripes, usually separated by rows of black spots on dorsal area; lateral area with a white and black pattern of bars; throat sometimes slaty in color, or marked with black spots; chest may be checkered with black, but is not normally solid black.

The scales around body and the O-R counts made on the few specimens (4) in the Museum of *C. t. tigris* (Riverside, Kern, Imperial counties, Calif.) are closer to the counts of *gracilis*, although the around body counts are high, as would be expected on geographic grounds. Counts were as follows: O-R 167, 165, 160, 150; around body 85, 76, 77, 76.

Thirteen specimens from Yuma County are apparently intergrades between *gracilis* and the *tigris* of Stebbins (1954: 326), who shows the range of the subspecies *tigris* extending into southeastern California. Stebbins notes that Savage is of the opinion that *tigris* as denoted (*op. cit.*) is probably a composite group. The intergrades are significant as support for the restricted type localities of *gracilis* and *melanostethus*. The following characters suggest intergradation: the chest color ranges from solid black (4), to a slaty color (1), with most of them having the anterior one-half of the individual scales black and the posterior one-half light. The gular region ranges from solid black (2), to slaty, with the majority having a light background or slaty with black spots scattered on it; dorsal pattern ranges from 4

wide, brown dorsal stripes (3), to a nondescript mottling of brown and black on the dorsal surface, with no indication of stripes, and a tendency to form irregular black and white bars in lateral areas. Eight specimens have a broken black line on the ventral surface of the tail; the remainder have a uniform whitish or yellowish-brown on the undersurface of the tail. The supraocular granules range from the middle of the frontoparietal to the posterior edge of the frontal.

The Altar, Sonora, specimens (4) suggest intergradation between *gracilis* and *aethiops*; not only are they from an intermediate geographic area, but the scale counts (though based on few specimens) are definitely lower, with one O-R count falling within the range of *gracilis*; O-R counts near Altar, 171 and 180; around body, 68 and 69; 25 mi. E Altar O-R counts 180 and 184; around body both 74.

The dorsal scale (O-R) counts tend to increase in a southern direction. For example Pima County specimens (9) which are near the southern extremities of the range for *gracilis* have O-R counts ranging from 149 to 172, with an average of 160, which is distinctly higher than the overall average of *gracilis*.

The line of intergradation must be in extreme north Sonora from an area slightly south of the Baboquivari Mountains, Arizona, westward and northeastward, although in the absence of specimens the status of populations of the Gran Desierto, Sonora, can only be surmised; Yuma County specimens indicate that the influence of both subspecies may be expected.

In summary, both races are black chested, with *aethiops* typically having most of the belly black. The subspecies *gracilis* is slightly larger and has a distinctly lower O-R and around body scale counts. The stripes of *gracilis* tend to be wider and often brown in color; however, they may be lacking in large specimens. The stripes of *aethiops* are narrower, usually light colored, and normally always present.

The subspecies *gracilis* ranges from the southern edge of the Colorado Plateau in the southwestern one-fourth of the state, westward to the Colorado River and eastward to a line approximately equal with the Baboquivari Mountains and southward into extreme northern Sonora. *Cnemidophorus t. aethiops* ranges from southeast Arizona and probably southwest New Mexico and adjacent Chihuahua southward through Sonora and several adjacent islands, and probably reaches northern Sinaloa. More collecting is needed in southeastern Arizona, southwestern New Mexico and adjacent Chihuahua before the range can be accurately delimited.

Hypsiglena torquata subsp. A male (38726), badly damaged

anteriorly, from Kingman, Mohave County, is atypical of *H. t. ochrorhyncha* Cope in dorsal pattern. Specimens from Pima County (reported by Hensley, 1950: 284) have a dorsal pattern of single cross bars, whereas in the Mohave specimen the dorsal pattern is broken to form a two row checkerboard pattern, which becomes a single bar posteriorly near the tail. Scale rows above vent 15. Head pattern indistinguishable due to damage; body blotches 51. White interspaces narrow, 1 scale wide, whereas in typical *t. ochrorhyncha* it tends to be 1½ to 2 scales wide. Total length 219 mm.; tail 42 mm.

Salvadora hexalepis subsp. Cope. A specimen (43201) representing a possible intergrade population between *h. hexalepis* and *h. deserticola* Schmidt is from 1 mi. E Bates Well, Organ Pipe Cactus National Monument, Pima County. The *deserticola*-like characteristics are 2 supralabials in contact with orbit, an undivided loreal, dorsal surface of head brown. However, the lateral dark stripes are found on the third and fourth scale rows, as in *hexalepis*.

Tantilla wilcoxi wilcoxi Stejneger. One (17543), Miller Canyon, 15 mi. S Fort Huachuca, Cochise County, is from the northern extremity of known range. It agrees with the description of Stebbins (1954: 452) in having a black head, bordered by a light stripe which crosses the posterior tips of parietal scales. Total length 227 mm.; tail 57 mm.

Crotalus atrox Baird and Girard. Two (43202–03), 12 mi. ENE Sells, and 1 mi. S Topawa, both in Pima County, deviate from typical *atrox* in head scutellation. In the most anterior scale row between the supraoculars there are only 3 scales, the lateral distinctly larger than the medial, whereas in typical *atrox* there is usually a minimum of four nearly uniform scales. Klauber (1930: 105) states that only 11 per cent of *atrox* (examined by him) have a minimum bridge of three scales.

The specimens have the postocular light stripe intersecting the mouth, and black caudal rings are nearly same width as white rings, as in *atrox*.

Two (adult males, 38730–31), 8½ mi. NE Kingman, Mohave County, are from near the northern extremities of known range in Arizona. They are typical in pattern and scutellation.

Crotalus molossus molossus Baird and Girard. A male (38734), ½ mi. S Castle Dome Mine (Castle Dome Mountains), Yuma County, is total length 998 mm., tail 72 mm.; ventrals 189; subcaudals 26; mid-body dorsal scale rows 26. Another male (38735), Carmelita Mine, 12 mi. ESE Wenden, S side Harquahala Mountains, Yuma

County, is total length 950 mm.; tail 81 mm.; ventrals 188; subcaudals 28; mid-body dorsal scale rows 26. Both localities are from the western edge of the known range.

Head scutellation typical; tail black; black on subcaudal surface not extending to vent as is typical of the more eastern populations. Both are extremely faded in body color and pattern. Dorsally the distinction between body blotches and interspaces is slight. They tend to lack the white border around body blotches of typical Arizona "black-tails". Laterally and slightly posterior to mid-length the pattern is approximately as follows: 2–3 rows dark scales, 1–1½ rows white or light scales, etc. There is some dark pigment on the snout, but not as abundant as in typical specimens.

Crotalus viridis cerberus Coues. Four (24542–44, 31351), all Graham County: Marijilda Canyon campground, Graham Mountains; Noon Creek Campground, Graham Mountains; Fort Grant Road, 2 mi. S Maverick Mountain.

All adult males; ground color dark, dorsal blotches distinctly darker than ground color, bordered anteriorly and posteriorly by white scales; usually no interspaces between middorsal body blotches except for white borders; in agreement with Klauber's key (1957: 107) in having two loreals and one or more scales at rostal between prenasal and first supralabial. Measurements in mm. (respectively): total length 783, 735, (24543 too badly damaged to measure accurately), 805; tail 62, 56, (not measured), 63.

Crotalus viridis nuntius Klauber. One (2636), probably a juvenile, Flagstaff, Coconino County; total length 258 mm.; tail 17 mm. Dorsal body blotches distinct, separated by 1½ to 2 scale rows; midbody scale rows 25.

Crotalus viridis abyssus Klauber. A male (35956), Hilltop, south rim of Grand Canyon National Park, Coconino County, shows no evidence of intergradation with *nuntius*. Light ground color; dorsal body blotches present but not distinct. Total length 650 mm.; tail 50 mm.; midbody scale rows 25.

Micruroides euryxanthus euryxanthus Kennicott. One (43199), 19

TABLE 2

Scale counts for Cnemidophorus tigris gracilis and C. t. aethiops.

Characteristic	N	*C. t. gracilis*	N	*C. t. aethiops*	t	P
Scales O–R	50	152.1±1.4(134–172)	49	190±1.8(176–225)	16.7	.001
Scales around	48	71.1±1.92(60–81)	38	80.8±1.5(73–91)	4.02	.006

O–R, occiput to rump; *around*, around midbody, excluding ventrals.

mi. S, 8 mi. W Casa Grande, Pinal County, with dorsal parts of red bands obliterated by black pigment, giving the impression of a black and white banded snake; on ventral surface red bands completely distinct. The red scale count (70) falls well within the range (43–93) set up by Zweifel and Norris (1955) for *euryxanthus*.

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THE SOUTHWESTERN NATURALIST 5 (1): 37–42 APRIL 15, 1960

TWO NEW GECKOS, GENUS *PHYLLODACTYLUS* (REPTILIA:SAURIA), FROM MICHOACAN, MEXICO

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ABSTRACT. Two new geckos, *Phyllodactylus duellmani* and *Phyllodactylus paucituberculatus*, are described. The new species are based on specimens from the lower Balsas drainage of Michoacán, Mexico. The holotypes are in the University of Michigan Museum of Zoology. A brief summary of the natural groups of *Phyllodactylus* occurring in Mexico is given, along with characters used to distinguish these groups.

Three distinct species groups of the genus *Phyllodactylus* occur in Mexico. One of these, represented only by *unctus*, is known from Baja California and adjacent islands, but apparently several species in South America are closely related to it. The *delcampi* group is known from the coastal foothills of the Sierra del Sur in Guerrero, the Balsas Basin in Michoacán, and the coastal region of Peru. In addition to *P. delcampi*, the two species described below are referred to this group. The most widespread is the *tuberculosus* group, which extends from southern California southward through Baja California, the western coast of Mexico, Central and South America, to the Galapagos and Caribbean Islands. In addition to *tuberculosus*, species belonging to this group are *homolepidurus*, *lanei*, *magnus*, *muralis*, *ventralis*, *eduardofischeri*, *wirshingi*, *spatulatus*, *darwini* and possibly others from South America.

These groups are characterized by the number of longitudinal rows of enlarged dorsal tubercles and by the size of the tubercles. In many of the South American forms, the dorsal tubercles are either absent or reduced in size and number, and the snout-vent distance is frequently short. The first of the new species described herein is similar to *P. abrupteseriatus* from Peru in having the number and size of the large dorsal tubercles reduced and the snout-vent distance short. The second new species described is related to *P. delcampi*.

Phyllodactylus **duellmani**, new species

HOLOTYPE. UMMZ 118932, an adult male, from Rancho El Espinal, 5.2 miles by road from San Salvador, 1600 feet above sea level,

Michoacán, collected by William E. Duellman and John Wellman, June 22, 1958. Original number WED 12571.

PARATYPES. UMMZ 119294–95, (WED 12572–3) from El Espinal and UMMZ 115104 (WED 11038) from 1.6 miles N. of Capirio, 600 feet, Michoacán. (This species is named for William E. Duellman, one of the collectors who has contributed much to our knowledge of the Mexican herpetofauna.)

DIAGNOSIS. A small *Phyllodactylus* with a maximum known snout-vent length of 42 mm.; ten dorsal longitudinal rows of enlarged keeled, somewhat flattened tubercles; no enlarged tubercles on tail; reduced number (10) of loral scales between eye and nostril; distinct black stripe from nostril through eye to behind insertion of arm; posterior half of tail banded.

DESCRIPTION OF HOLOTYPE. Head not greatly flattened, neck somewhat constricted; loral region ovate, slightly swollen; no depression in frontal region; rostral twice as wide as high; nostril bordered by internasal, two postnasals, first labial, and rostral; internasals slightly wider than long; 17 scales between middle of orbits, 15 scales between anterior edge of orbits; 10 scales across snout at third labial, 15 at second labial; 10 loral scales between eye and nostril; 13 supralabials (6th below middle of eye); 10 infralabials (5th below middle of eye); scales bordering supralabials somewhat rounded, not imbricate; posterior half of outer row of superciliaries moderately pointed; diameter of eye contained in snout length slightly less than twice; auricular opening small, not denticulate; occipital scales sub-equal to interorbital scales, with intermixed, larger rounded tubercles; mental as wide as long, lyre shaped when viewed from below; two postmentals, narrowly in contact with each other and touching two labials; postmentals followed by a transverse row of seven smaller scales; body granular above with ten longitudinal rows of slightly enlarged, keeled, somewhat flattened tubercles; six of these rows extend from anterior to insertion of arm to base of tail; 33 tubercles in median dorsal row from rear of head to base of tail; 26 enlarged tubercles between axilla and groin; 25 rows of flat, cycloid scales across venter, 48 from gular region to anus; ventral scales of belly about three times larger than lateral body scales.

Upper arm with flat, imbricated scales on anterior and posterior surfaces; lower arm similar, but posterior face with smaller rounded scales; femur similar to arm but scales granular on posteroventral surface; dorsal surface of lower legs with about five to seven scattered, large, rounded tubercles intermixed with granules.

Digital lamellae formula for hand, 7–8–9–8–6 (undivided,

4–6–6–5–3); foot, 5–8–9–11–9 (undivided, 3–5–6–7–4); terminal pads twice as long as wide, tips square or only slightly rounded; claw almost completely hidden between terminal pads, only the tip visible; three laterally oblique, postanal tubercles; tail annulated, scales in irregular transverse series, slightly keeled with posterior edges rounded; mid-ventral row of caudal scales wider than long, about three times larger than those of dorsal surface of tail.

Measurements in mm.: snout-vent length, 40; length of head, 12; width of head, 8; axilla-groin length, 18; length of leg, measured from leg insertion to tip of toe, 15; length of arm, from arm insertion to tip of toe, 11; diameter of eye, 2; diameter of ear, 1.

Color in life (from field notes of William Duellman): "pale grayish tan above, whitish below." Color in alcohol: ground color tan, top of head and dorsal surfaces of limbs slightly darker; no spots on arms or legs; venter sub-immaculate, each scale with two to four black specks; dorsum with small black spots in eight irregular transverse rows, spots cover 16 or fewer granules; head minutely spotted with black; black stripe from nostril through eye to posterior edge of arm insertion; proximal half of tail with double row of black spots, distal half with black spots, distal half with black bands.

VARIATION. The three paratypes differ from the type in having the postmentals touching the first labial only. However, this type of variation is found in other species of *Phyllodactylus*, and its systematic significance is not apparent in small series of specimens. The row of seven scales following the postmentals is constant in the type series. Orbital scales range from 15 to 17; scales across the snout between third labials 19 to 20, 20 occurring in three of four specimens. Scales bordering internasals range from 5 to 7; scales across venter, 23 to 25; six rows of enlarged dorsal tubercles extend to base of tail in all, and none has enlarged tubercles on dorsal surface of tail. Number of enlarged dorsal tubercles in median row from rear of head to base of tail range from 32 to 37, between axilla and groin, 25 and 26; snout-vent length, 37 to 42 mm., juvenile, 18 mm.

The two paratypes from El Espinal are similar to the type in color and pattern. However, Duellman's field notes state that the tail of the juvenile was orange in life. I know of no other species of *Phyllodactylus* that has orange on the tail in juvenile or adult stages. The third paratype from near Capirio is similar to the type in having the distinct loral stripe; however, it differs in having the dorsum minutely spotted with black, with no indication of irregular transverse spots or bands. The ground color is brownish gray, with limbs and head slightly darker.

REMARKS. *Phyllodactylus duellmani* differs from all other Mexican species of the genus, except the second new species described herein, in having 10 longitudinal rows of enlarged dorsal tubercles, the tubercles about three times larger than the surrounding granules. In the latter respect, *duellmani* is similar to *delcampi* but differs from it in being much smaller, 37 or fewer enlarged dorsal tubercles in median row from rear of head to base of tail, rather than 50 or more; 26 or fewer tubercles between axilla and groin rather than 33 or more; different color and pattern.

Phyllodactylus duellmani, placed in the *delcampi* group, resembles certain forms from South America and the Galapagos Islands. It is similar to *P. abrupteseriatus* from Peru. *P. unctus* is another Mexican species that shows similarities to South American forms. The trend toward few enlarged rows of dorsal tubercles or the absence of dorsal tubercles occurs frequently in South American forms, but not in Central American species. Possibly *duellmani* and *unctus* are relict populations derived from South American forms or they may have evolved independently from some ancestral stock in Mexico.

The type and two paratypes collected near El Espinal were taken from a hollow branch of a tree, *Apoplanesia paniculata*. The third paratype from north of Capirio was taken from a stump in an arid scrub forest.

Phyllodactylus **paucituberculatus**, new species

HOLOTYPE. UMMZ 112692, an adult female from near the Río Cupatitzio, 6.5 miles south of Lombardia, 1150 feet above sea level, Michoacán, collected by William E. Duellman, July 13, 1955. Original number WED 7401.

PARATYPE. UMMZ 112693, an adult female collected with the type.

DIAGNOSIS. A moderate sized *Phyllodactylus* with a known maximum snout-vent length of 57 mm.; axilla-groin region with 18 or fewer enlarged keeled tubercles; four rows of enlarged dorsal tubercles extending to base of tail; no enlarged tubercles on femur or forearm; two minute postanal tubercles on each side of tail; tail without enlarged dorsal tubercles.

DESCRIPTION OF HOLOTYPE. Head flattened, neck slightly constricted; loral region with scales four to five times larger than interorbital scales; rostral twice as wide as high, median dorsal edge depressed, indistinctly "Y" shaped; nostril bordered by rostral, two postnasals, internasal, and labial; internasal bordered posteriorly by three granules and postnasal; 17 scales between middle of orbits, 14 between anterior edge of orbits; 19 scales across snout between third labials, 13

between second labials; three rows of granular supraoculars and one row of larger superciliaries, last four or five superciliaries pointed; slight depression behind nostrils and in frontal and interorbital regions; auricular opening large, denticulate, but projecting scale edges short and somewhat blunt; diameter of eye equal to one-half length of snout; 10 supralabials (6th below middle of eye); 9 infralabials (4th below middle of eye); mental longer than wide, bordered by two postmentals which contact two labials on each side; postmentals bordered posteriorly by transverse row of six smaller scales, followed by another row of 11 scales.

Dorsum with ten longitudinal rows of enlarged, weakly keeled tubercles; six rows extend to neck, four reach base of tail; enlarged dorsal tubercles in longitudinal series separated from each other by two or three granular scales; median two rows of enlarged dorsal tubercles separated from each other by four rows of granules; tail without enlarged tubercles; ventral surface of tail with 46 longitudinal scales, twice as wide as long; upper arm with flat, imbricate scales on dorsal and anterior surfaces and granular scales on posteroventral surfaces; scales on anterior and dorsal surfaces of femur flat and imbricate; those on posteroventral surfaces granular; postero ventral surface of lower leg without larger, intermixed tubercles; two minute postanal tubercles on each side; digital lamellae formula for hand, 7–9–10–11–9 (undivided, 3–5–6–6–3); foot, 7–9–12–13–11 (undivided, 3–6–7–6–4); terminal pads one-third longer than wide, claw barely projecting beyond anterior edge of pad, only the tip visible from below; 24 rows of scales across venter, 56 from gular region to anus.

Measurements in mm.: snout-vent length, 57; axilla-groin length, 28; length of head, 15; width of head, 10; length of snout, 7; diameter of eye, 4; diameter of ear, 2; length of tail, 55; length of arm, 16; length of leg, 24.

Color in life (from field notes by Duellman): "pale ashy gray with darker flecks above, dusty cream below"; color in alcohol: ground color brownish-gray with median row of black subcircular rings enclosing whitish spots; head, tail, and limbs slightly darker than dorsum, minutely spotted with black; ventral surfaces of digits slate; belly much lighter, grayish-white, immaculate.

VARIATION. The paratype resembles the type in most characters but differs in having eight scales bordering the postmentals posteriorly, 13 scales across the snout between second labials, 7 supralabials and 6 infralabials to below middle of eye, 62 scales from gular region to anus. The color differences are minor but the pattern is more distinct in the paratype. The black subcircular rings enclosing the whitish

spots are more pronounced and the lateral blackish spots tend to unite with median black rings, gaving an appearance of transverse hourglass markings.

REMARKS. *P. paucituberculatus* is related to *P. delcampi* from the Tierra Colorado region of Guerrero, Mexico. The latter species reaches a maximum snout-vent length of more than 90 mm. and has smaller, but more numerous, enlarged rows of dorsal tubercles. *P. paucituberculatus* has larger snout scales; larger and more numerous tubercles on rear of head; median row of enlarged dorsal tubercles from rear of head to base of tail, 21 or less rather than 50 or more; number of tubercles in axilla-groin region 18 or less rather than 33 or more; scales between eye and nostril 9 rather than 12 or more; scales across venter 24 or less rather than 26 or more; undivided lamellae of fourth toe 8 or less rather than 10 or more.

P. paucituberculatus was collected by Duellman in crevices along a rocky cliff bordering the Río Cupatitzio. There is every indication that the genus as a whole is highly plastic. One species may occupy a very small geographic range (*delcampi*, *paucituberculatus*) while others may have a wide range (*tuberculosus*, *lanei*, *magnus*, *homolepidurus*).

ACKNOWLEDGMENTS

I wish to take this opportunity to thank Norman Hartweg for the loan of specimens from the Museum of Zoology, University of Michigan, and William B. Davis for loan of comparative material from the Texas Cooperative Wildlife Collection. I also wish to thank Richard J. Baldauf, William B. Davis, and William E. Duellman for their critical reading of the manuscript.

THE SOUTHWESTERN NATURALIST 5 (1): 43–47 APRIL 15, 1960

NOTES

NOTES ON THE BRYOPHYTES OF GARNER STATE PARK, TEXAS.—Garner State Park in northern Uvalde County, Texas, lies at the southern edge of the Edwards Plateau. The Park consists mainly of limestone bluffs and a floodplain extending along a three mile section of the Frio river. Numerous mosses and liverworts have been collected that show an affinity to the eastern species in the United States and a few to the western forms.

Moss collections have been reported from only 134 of the 234 Texas Counties, totaling 289 species (Whitehouse, The Bryologist, 1954, 57:53–146.) Eighty-nine liverworts are recorded from 35 counties in the state. Only one species, *Riccia albida* Sull. has been reported from all of Uvalde County (McAllister, Hoglund and Whitehouse, Jour. Texas Acad. Sci., 1930, 15:40–59; Whitehouse, Mitteilungen der Thuringischen Botanischen Gesellschaft 1955, 1: 231–235.)

The following list of bryophytes includes three hepatics and 19 mosses. With each citation I have listed the nearest previously reported county collection in parentheses and the relative abundance of the species in the Park. All the collection numbers are my own. Collections have been placed in the herbarium of Texas Technological College and in my own herbarium.

HEPATICAE

Frullania eboracensis Gottsche; 2331; (Travis, only 2 stations). Common on the bases of trees in the Park.

Frullania riparia Hampe; 2338; (Travis, only 2 stations). Common on the bases of trees and on soil in the Park.

Pellia epiphyllia (L.) Corda.; 2317; (reported from Texas in 1937 by Frye and Clark but no county is listed). Infrequent in the Park.

MUSCI

Fissidens obtusifolius Wils.; 2311; (Bexar). Quite common and mixed with other mosses on limestone and soil.

Desmatodon obtusifolius (Schwaeg.) Jur.; 2293; (Camal) Most abundant of the Park mosses, found widespread on soil.

Didymodon tophaceous (Brid.) Jur.; 2296; (Kerr) Common on soil and limestone outcrops throughout the Park.

Tortula muralis Hedw.; 2287; (Atascosa) Common on soil and limestone outcrops throughout the Park.

Ephemerum cohaerens (Hedw.) Hampe; 2290; (Travis) Moderately common on silty soil of the floodplain.

Funaria calvescens Schw.; 2294; (Harris) Infrequent on soil and limestone outcrops in the Park.

Funaria hygrometrica Hedw.; 2299; (Travis) Common on limestone outcrops and infrequently found on soil of the floodplain.

Orthotrichum strangulatum Schw.; 2329; (Llano) This is the second reported collection of the species in Texas. Fairly common and mixed with other mosses on limestone and soil.

Bryum argenteum (L.) Hedw.; 2281; (Edwards) Infrequently found on soil in the Park.

Amblystegium varium (Hedw.) Lindb.; 2307; (Bexar) Common on moist soil near springs and along the Frio river in the Park.

Brachythecium collinum (Schleich.) Bry. Eur.; 2310; (Brewster) Reported only from a few stations in far west Texas. I collected this species from only two stations, on moist soil, in the Park.

Entodon seductrix (Hedw.) C. M.; 2295; (Travis) Very common on the base of trees in the Park.

Homomallium adnatum (Hedw.) Broth.; 2317; (Real) Fairly commonly found mixed with other mosses on the base of trees in the Park.

Plagiothecium turfaceum (Lindb.) Lindb.; 2312; (Gillespie) Infrequent on soil near the moist base on the limestone bluffs in the Park.

Sematophyllum adnatum (Mx.) E.G.B.; 2301; (Real) Very common on Cedar trunks and limestone throughout the Park. Often mixed with other mosses.

Anomodon minor (Beauv.) Lindb.; 2305; (Harris) Collected from only one station in the Park, on moist soil.

Thelia hirtella (Hedw.) Sull.; 2281; (Real) Common on the base of trees throughout the Park.

Leucodon julaceus (Hedw.) Sull.; 2348; (Kerr) Common on the base of cypress trees near the Frio river.

Clasmatodon parvulus (Hampe) Sull.; 2309; (Real) Previously reported from only three stations in central Texas. In the park it is infrequent on the stems of cedar trees.

Although collections from other Texas areas are too few to permit specific comments on the affinities of the flora of Garner State Park, it seems clear that the bryophytes are more closely allied to the eastern forms than the western. Of the twenty-two species listed for the Park only two, *Didymodon tophaceous* and *Brachythecium collinum*, are primarily western. The latter species is roported to have been previously collected only in far west Texas. *Orthotrichum strangulatum*, primarily an eastern form has been reported only once before in Texas. There is strong evidence that Garner State Park is close to the boundary of western and eastern bryophytic distribution, or else the area is a favorable site for the eastern species although somewhat isolated from the eastern floristic element.—*Paul V. Prior, Biology Department, Texas Technological College, Lubbock, Texas.*

PARTURITION OF THE BLUE SPINY LIZARD, SCELOPORUS CYANOGENYS COPE.—Most lizards of the genus *Sceloporus* lay eggs, but some species give birth to their young as the normal means of reproduction. The blue spiny lizard, *Sceloporus cyanogenys*, is a live bearing member of the large *torquatus* species group (Smith, 1946, *Handbook of Lizards*, Comstock Publishing Co.) whose reproductive habits are poorly known. Two other live bearing members of the *torquatus* group occurring in the United States are *Sceloporus poinsetti* and *Sceloporus jarrovi* The young of the latter two lizards have been mentioned by Axtell (1950, Herpetologica 6: 80–81), Ramsey and Donlon (1949, Copeia no. 3, 229) and Zweifel (1949, Herpetologica 5: 152) but there is little published information concerning the reproductive habits of *S. cyanogenys*. Apparently the only account of reproduction in this lizard is that of Smith (1939, Field Mus. Nat. Hist., zool. ser. vol. 26: p. 223) who stated "Eleven young were borne June 2, 1937, by a female specimen collected by Stanley Mulaik at Arroyo Los Olmos, three miles southeast of Rio Grande City, Starr County, Texas (UMMZ)".

Several adult males and a female blue spiny lizard have been maintained together since November, 1958. These lizards were obtained from an animal dealer in Laredo, Texas and were probably collected in that vicinity. Temperature in the laboratory was approximately 27°C from November through February. It seems highly probable that mating occurred in captivity because of the early date on which this female gave birth. Lizards were fed on various insects obtained by sweep nets and were occasionally force fed new-born white mice.

On the morning of February 28, 1959, a female measuring 108 mm. snout-vent, 152 mm. tail, was observed giving birth. The temperature in the cage was 27.5°C. Most of the young were born before my observations began. One young lizard was lying on the floor of the cage still enclosed in the extraembryonic membranes with the tail coiled upon itself. The membranes were ruptured by a quick forward thrust which may have been facilitated by the coiled tail. The newly emerged lizard ran for a short distance with the extraembryonic membranes adhering to the tail.

Contractions were seen in the posterior abdominal region on the female's right side as she remained motionless, elevated on the forelegs with the head held high and the body somewhat *S* shaped. Five minutes after the first observed contraction the female erected the tail at the base and the young lizard emerged head first and not enclosed in extraembryonic membranes. This individual was moist and opened the jaws wide while running a short distance. I inspected the cloaca of the adult and removed the extraembryonic membranes. In addition to the large number of young two small eggs which failed to develop were found on the floor of the cage. Measurements of the 17 young were made on the day of their birth, February 28, 1959, and are as follows:

	Range	Mean	Standard Deviation	Standard Error
Snout-vent (mm.)	28–30	29.2	0.55	0.13
Tail (mm.)	34–38	36.0	1.09	0.26
Interorbital width (mm.)	5.7–6.3	5.9	0.17	0.041
Weight (grams)	0.6–0.9	0.8	0.07	0.017

Snout-vent and tail lengths were obtained by placing the lizard against a standard millimeter rule. Vernier calipers were used to measure interorbital width and a trip scale single beam balance to determine weight. Conant (1958, *A Field Guide to Reptiles and Amphibians*, Houghton Mifflin Co.) lists total lengths of 2½ to 2¾ inches for this species at birth.

Sex was based upon the presence of enlarged postanal scales in males and their absence in females. Of the 17 young 5 were males with a mean snout-vent and tail length of 29.4 mm. and 36.8 mm. respectively. The mean snout-vent and tail lengths of the 12 females were 29.2 mm. and 35.7 mm. respectively. The pattern of the young was similar to that of the adult female.—*J. P. Kennedy, Department of Biology, University of St. Thomas, Houston 6, Texas.*

ORIENTATION BY HOLBROOKIA MACULATA (LACERTILIA, IGUANIDAE) TO SOLAR AND REFLECTED HEAT.—C. M. Bogert (1959, Sci. Amer., 200 (4): 105–120) has published a discussion dealing with voluntary body orientation in lacertilians to thermal radiations from our sun. By positioning themselves in various ways lizards can utilize solar heat with an efficiency suitable to regulate

their body temperature within rather narrow limits of their optimum operating temperature. Bogert includes drawings in his article, but photographic substantiation for some of his assertions and observations (see for *Holbrookia texana* p. 115) are lacking.

On June 4, 1959, I had the opportunity to observe, in the field, behavior by *Holbrookia maculata* which augments Bogert's work, and in addition suggests behavioral ramifications which have not received previous attention. The following observations were made on a dry alluvial flat, occasionally broken by bushy mesquite covered mounds, several hundred yards east of the city limits of Alpine (Elev. 4,300 ft.), Brewster County, Texas. At approximately 11:30 A.M., while working in this area, I noticed a gravid female *Holbrookia* as she ran to escape my step. From the time the lizard was first observed until about noon I noticed nothing unusual in her activities. At approximately 12:00 P.M. the female had moved to a small patch of weeds and climbed the numerous radiating branches until her body was entirely off the ground and directly parallel to the rays of the sun. By this time the soil surface had reached such high temperatures (exact readings were taken later and found to exceed 50 degrees centigrade) that the other lizards (two species of *Cnemidophorus*) frequenting the same area were confining their activities to shaded areas. Supposing this to be just a chance behavioral trait, I frightened the female from her perch in the weeds. Upon coming into contact with the hot ground surface she showed signs of discomfort and quickly ran to another patch of grass and weeds where she assumed a similar position, again parallel to the sun's almost vertical rays. After two more episodes like that described above, I became convinced that the female was employing a definite and probably instinctive behavioral maneuver. Subsequently (12:45 P.M.) photographs were taken and the best of these (Fig. 1) are included here.

Whether this behavior is common to other species, subspecies or even individuals

Fig. 1. Adult female *Holbrookia maculata* perched in a position parallel to the sun's rays. Note the shadows.

of *Holbrookia* is unknown. It may be a special behavioral trait practiced only by gravid females to allow their eggs more heat for development. According to my own field experience females heavy with eggs tend to stay abroad longer diurnally than males, nongravid females or young. This female did not seek deep shade until about 1:15 P.M., long after other lizards had terminated their activities.

It is significant that this lizard, by climbing only several inches above the soil surface and orienting the long axis of her body parallel to the sun's radiations minimized the danger from both the intense radiated heat accumulating on the soil surface, and the heat and harmful radiation coming directly from the sun. Air temperature only two inches above the surface was ten degrees centigrade cooler.—*Ralph W. Axtell, Dept. of Biology, Sul Ross State College, Alpine, Texas.*

THE SOUTHWESTERN NATURALIST 5 (1): 48 APRIL 15, 1960

REVIEWS

DRAWINGS OF BRITISH PLANTS. STELLA ROSS-CRAIG. Part XIII (Umbelliferae II. Araliaceae, Cornaceae). G. Bell & Sons, Ltd. London. 1959. 9 shillings, 6 pence.

Portrayals of plants by means of line drawings commonly reveal numerous deficiencies which, at length, require the referee to take a rather lenient view toward the accuracy they are intended to reflect. Absence of third dimension or "depth," inadequate attention to fine details of pubescence and of small flowers, unnatural disposition of parts, overemphasis of certain parts, omission of roots and much of the stem—these are all valid criticisms of the majority of drawings included in various "illustrated floras." Happily, *Drawings of British Plants* stands apart as a unique work, not only because faults of inaccuracy and incompleteness are held to a minimum, but also because the author displays such artistic talent as to conserve some of the "personality" of the living organisms, yet without stepping into that never-never land of what is disdainfully called "artistic license."

The present part, certainly one of the more difficult to execute, follows the pattern established in earlier numbers. Each species is represented by a habit drawing of the entire plant, supplemented with close-ups of leaf, inflorescence, flower, fruit, lower stem and root, and other details important to identification. Special features, such as type of pubescence, oil glands, individual petals, are shown as they would appear under the dissecting microscope. All drawings are referred by letter to a legend at the bottom of the page.

The only censure one can make of the undertaking, aside from its very limited utility in North America, emanates from a limitation inherent in depicting a species, usually variable in nature, by a single fixed image. It is clear that much has depended upon the selection of truly representative material. Even more will depend upon the interpretive ability of the user who must resist the common tendency, equally to be avoided with herbarium material, to regard a solitary portrayal as one encompassing the limits of the variation in the species concerned.

But none of this adversely affects the superb achievement of Miss Ross-Craig, whose work will surely rank as a standard in illustrative art. On that basis alone *Drawings of British Plants* can be recommended for inclusion in American libraries.—*H. S. Irwin, Department of Botany, University of Texas, Austin.*

INFORMATION FOR CONTRIBUTORS

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CONTENTS

Botany

The Genus *Savia* (Euphorbiaceae) in Extreme Western Texas. *Barton H. Warnock and Marshall C. Johnston* . . 1

A Cytological Difference Between the Eupanicoideae and the Chloridoideae (Gramineae). *Walter V. Brown* . . . 7

Meiotic Chromosome Numbers in Texas Species of the Genus *Coreopsis* (Compositae-Heliantheae). *B. L. Turner* . . 12

Zoology

Noteworthy Records of Skinks (Genus *Eumeces*) from Northwestern Mexico. *John M. Legler and Robert G. Webb* . . 16

The Taxonomic Status of Oklahoma Beavers, *Castor canadensis*. *Bryan P. Glass* 21

Taxonomic Notes on Arizona Herpetozoa. *Kenneth L. Williams* 25

Two New Geckos, Genus *Phyllodactylus* (Reptilia: Sauria), from Michoacán, Mexico. *James R. Dixon* 37

Notes

Notes on the Bryophytes of Garner State Park, Texas. *Paul V. Prior* 43

Parturition of the Blue Spiny Lizard, *Sceloporus cyanogenys* Cope. *J. P. Kennedy* 44

Orientation of *Holbrookia maculata* (Lacertilia, Iguanidae) to Solar and Reflected Heat. *Ralph W. Axtell* 45

Reviews

Drawings of British Plants by Stella Ross-Craig. *H. S. Irwin* 48